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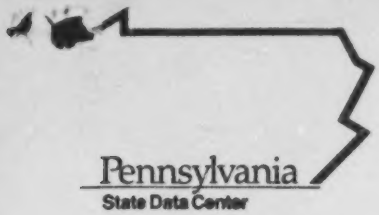

FERTILITY, MORTALITY and MIGRATION

Working Papers

PSDC80-14-86

Volume II

Pennsylvania State Data Center
The Pennsylvania State University
The Capitol Campus
Institute of State and Regional Affairs

Population Issues Research Center
The Pennsylvania State University
Institute for Policy Research and Evaluation

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Working Papers:
Fertiltiy, Mortality, and Migration:
State and Counties to the Year 2000

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Volume II

Pennsylvania State Data Center
Institute of State and Regional Affairs
The Pennsylvania State University
The Capitol Campus
Middletown, PA 17057

January 1986

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PENNSYLVANIA STATE AND COUNTY TOTAL AGE, SEX, RACE POPULATION PROJECTIONS, JULY 1, 1985, 1990, 1995, and 2000

by

Gordon F. De Jong, Daniel T. Lichter, Michael T. Behney, John M. Kennedy and Robert W. Surridge

Introduction

Population projections for the Commonwealth of Pennsylvania and its 67 counties are presented in this report. The set of population projections was completed by the Pennsylvania State Data Center in cooperation with the Population Issues Research Center of The Pennsylvania State University. In this section, the approach used to develop the age-sex-race (white-nonwhite) population projections for July 1, 1985, 1990, 1995 and 2000 is briefly described. Projections of whites and nonwhites are prepared for 18 counties with a nonwhite population of greater than 5000 persons. For counties with fewer than 5000 nonwhites, population projections by age and sex only are presented.

Baseline Projections vs. Forecast and Policy Goals

The numbers in this report are projections, not forecasts or predictions.

A projection is the measurement of a future population that would exist if the assumption of the method prove to be

empirically valid. Projections may assume continuations of past conditions, revisions based on present conditions, or trended changes in these conditions. Therefore, there are a number of possible projections for any given propulation.

A forecast, on the other hand is a judgmental statement concerning an expected population projected under certain types of future scenarios of economic or social conditions. All forecasts are projections, but not all projections are forecasts.

The projections in this report are not to be interpreted as policy goals. They are not intended to constrain or to advocate specific levels of growth in this state or any of its counties. Rather they are based primarily on identifiable demographic secular trends which have been implicitly or explicitly incorporated into the model. The greatest value of projections is as a reference point for planning, policy evaluation, the consideration of alternative public or private intervention activities, and the formulation and management of programs developed to deal with particular situations.

Demographic Cohort Model

The basic approach employed is a cohort-component demographic projection model. That is, the basic population is survived five years in each iteration of the projection cycle and births are projected by applying fertility rates

to survived females of childbearing age to determine the population due to natural increase. The survived population for each group is then adjusted for projected net migration by age-sex-race. The adequacy of this model depends on the accuracy with which the assumptions about future fertility, mortality, and migration reflect future demographic reality. The procedures used to make these assumptions are briefly described in the following sections.

Base Populations

The population counts for the projection model come from the April 1, 1980 U.S. Decennial Census. The base population includes revisions in the white-nonwhite counts that have been made by the U.S. Office of Management and the Budget for the approximately 90,000 Hispanics in Pennsylvania who responded as "other" to the question on race in the 1980 census. The base population includes persons in group quarters as of April 1, 1980 and thus the projections describe the resident population of the state. No adjustments were made to correct for possible under or over enumerations of the census count because no defensible adjustment procedure for these inaccuracies currently exist for undercount at the state or county level.

Fertility Rates

The cohort component model requires that assumptions be made about future fertility. The assumption about future trends in state fertility is directly tied to the Census Bureau's middle series of projected age-specific fertility rates. State trending was based on a careful analysis of the historic relationship between national and Pennsylvania age-race specific fertility rates. The national series assumes the ultimate level of completed fertility will be close to 1.9 births per woman by the end of the projection period. This project's analysis showed that Pennsylvania's fertility rates have been consistently lower than those for the nation. Therefore, the projections incorporate rates that capture the unique pattern of lower fertility and delayed childbearing in Pennsylvania compared to the national pattern. Based on the above methodology, it is projected that by the year 2000 the total fertility rate will be about 1.75 for white women and 2.08 for nonwhite women in Pennsylvania.

Projections of county patterns of fertility by race are based on a time-series analysis of the relationship between general fertility rates for counties and those of the state. The underenumeration correction factor prepared by the U.S. Bureau of the Census has been applied to nonwhite births. The sum of the county births by sex and rate are adjusted to equal the projected state sex-race totals.

Mortality Rates

State and county age-sex-race specific survival rates are based on state life tables and projected survivorship "middle mortality assumptions" data provided by the Social Security Administration. The white and nonwhite survival rate schedules for Pennsylvania assumed a continuation of the historic relationship of Pennsylvania rates to national rates through the year 2000. No major medical development had been assumed in the model. Survival rates are applied to births and to each age cohort. Since county level variation in life expectancy in Pennsylvania is due primarily to local area differences and the age-sex-race composition of county populations, by using age-sex-race specific schedules the projection model assumes that state rates are applicable for counties.

Updated Census Estimates

As part of the revenue sharing program of the federal government, the Census Bureau releases annual estimates for the preceding year of the total population of states and counties. While this information provides no age-sex-race detail, it does give a relatively accurate picture of the most recent population changes. In this report the most recent U.S. Bureau of the Census population estimate (July 1, 1984) totals have been used as a benchmark for each county in the development of 1985 population projections.

This procedure improves the accuracy of the projections for the immediate future.

Migration

Unlike for fertility and morality the Census Bureau does not project future patterns of net migration which are applicable to the local level. The migration rates used in this report are based on a thorough analysis of the unique age-sex-race-specific patterns of migration for the state and each county and on an analysis of trended changes in the level of migration.

Age-Sex-Race Migration Rate Pattern

In order to provide population projections by age-sex-race, it is necessary to have high quality migration rates for these population subgroups in the state and each county. The rates used in this report were derived from special tabulations of the question in the 1980 U.S. Census concerning place of residence on April 1, 1975. Net migration rates were calculated from this special census information as the ratio of net migrants to nonmigrants for each population subgroup in all 67 counties and the state. Although county net migration rates are trended, the 1975-80 age distribution of net migration rates derived from the special tabulations is held fixed throughout the projection

period. To enhance the stability of age-sex specific rates in smaller sized counties (less than 100,000 population), total age-specific rates as opposed to age-sex-specific rates were used. The comparative analysis of county age-specific migration patterns for 1965-1970 and 1975-1980 showed a remarkable stability in the age pattern of net migration rates.

Past, Present, and Projected Levels of State Net Migration

In addition to the age pattern of migration, the report's demographic projections are based on a thorough analysis of the level of net migration. As shown in Table 1, Pennsylvania has been and continues to be a net out-migration state. However, the level of net out-migration has declined continually over the last 35 years, from an average annual rate of -47,500 in the 1950s to -29,400 in the early 1980s. The population projections presented in this report assume that this remarkable regular pattern of decline in net out-migration from Pennsylvania will continue during the 1985-2000 projection period. The reduced level of net out-migration is consistent with the following trends in the determinants of migration: 1) the rapid reduction between 1985 and 2000 in the number of young Pennsylvania adults in the high out-migration 20-29 age cohorts (which will also reduce suburbanization in the years ahead), 2) a hypothesized increase in economic

opportunities, and the reduction in differences between the economic activity level of Pennsylvania and other states, 3) the increasing significance of amenities, such as the lakes and mountains found in some Pennsylvania counties, in residential choice decisions, and 4) the trend toward an increasing elderly population which has lower rates of out-migration and potentially significant return migration to the state. County net migration levels sum to the projected state totals presented in Table 1.

Projected County Patterns of Net Migration

Based on a detailed analysis of 1975 to 1980 and 1980 to 1985 net migration patterns derived from U.S. Bureau of the Census sources, on the previously mentioned trends in the determinants of net migration, and on trends in group quarter populations, a typology of projected net migration patterns for counties was developed. This typology also utilized unpublished Internal Revenue Service administrative record data on yearly changes in total county net migration rates for the early 1980s. Based on the above analyses, counties were assigned to thefollowing expected future migration typology categories: 1) continuing net out-migration rates, 2) slow reduction in net out-migration rates, 3) rapid reduction in net out-migration rates, 4) low and declining rates of net in-migration, 5) continuing low net in-migration rates, and 6) continuing high net

in-migration rates (Figure 1). The resulting expected number of migrants, derived from the trended migration rates for each of the projection years, were added to or subtracted from the survived population (see Daniel T. Lichter, et al., Pennsylvania Migration: 1965-2000).

Projection Procedure

In the projection process, first, the 1980 population is survived to 1985 using Pennsylvania's age-sex-race-specific survival rates. Second, the number of births is projected by applying fertility rates to the number of women in the childbearing age groups. Third, the number of net migrants in each age-sex-race group is added to or subtracted from the survived number of people in the respective groups. The resulting population figures then become the resident population base for the 1985 to 1990 projection cycle and the process is repeated (see Figure 2).

Future Plans

The Pennsylvania State Data Center plans to revise and modify these projections as more detailed census data becomes available and as sources of data are updated.

References:

1. John M. Kennedy, Gordon F. De Jong and Daniel T. Lichter, Fertility in Pennsylvania: 1960-2000. University Park, PA: Population Issues Research Center Working Paper, No. 1985-20, June, 1985.

2. Daniel T. Lichter, Gordon F. De Jong and John M. Kennedy, Mortality Experience in Pennsylvania: 1960-2000. University Park, PA: Population Issues Research Center Working Paper No. 1985-21, June, 1985.

3. Daniel T. Lichter, Gordon F. De Jong, John M. Kennedy and Janice Costanzo, Pennsylvania Migration: 1965-2000. University Park, PA: Population Issues Research Center Working Paper No. 1985-22, September, 1985.

Table 1

Number of Net Migrants for Pennsylvania,
1950-1985, with Projections to 2000

Time Period	Reported Number of Net Migrants During Interval	Average Annual Number of Net Migrants
1950-1960[1]	-475,000	-47,500
1960-1970[2]	-378,000	-37,881
1975-1980[3]	-177,800	-35,560
1980-1985[4]	-147,000	-29,400
1985-1990	-	-24,000 (projected)
1990-1995	-	-21,000 (projected)
1995-2000	-	-19,000 (projected)

Sources:

1. Gladys K. Bowles and James D. Tarver, Net Migration of the Population, 1950-60 by Age, Sex and Color. Vol. 1, Part 1. Washington, D.C.: U.S. Department of Commerce, 1985.

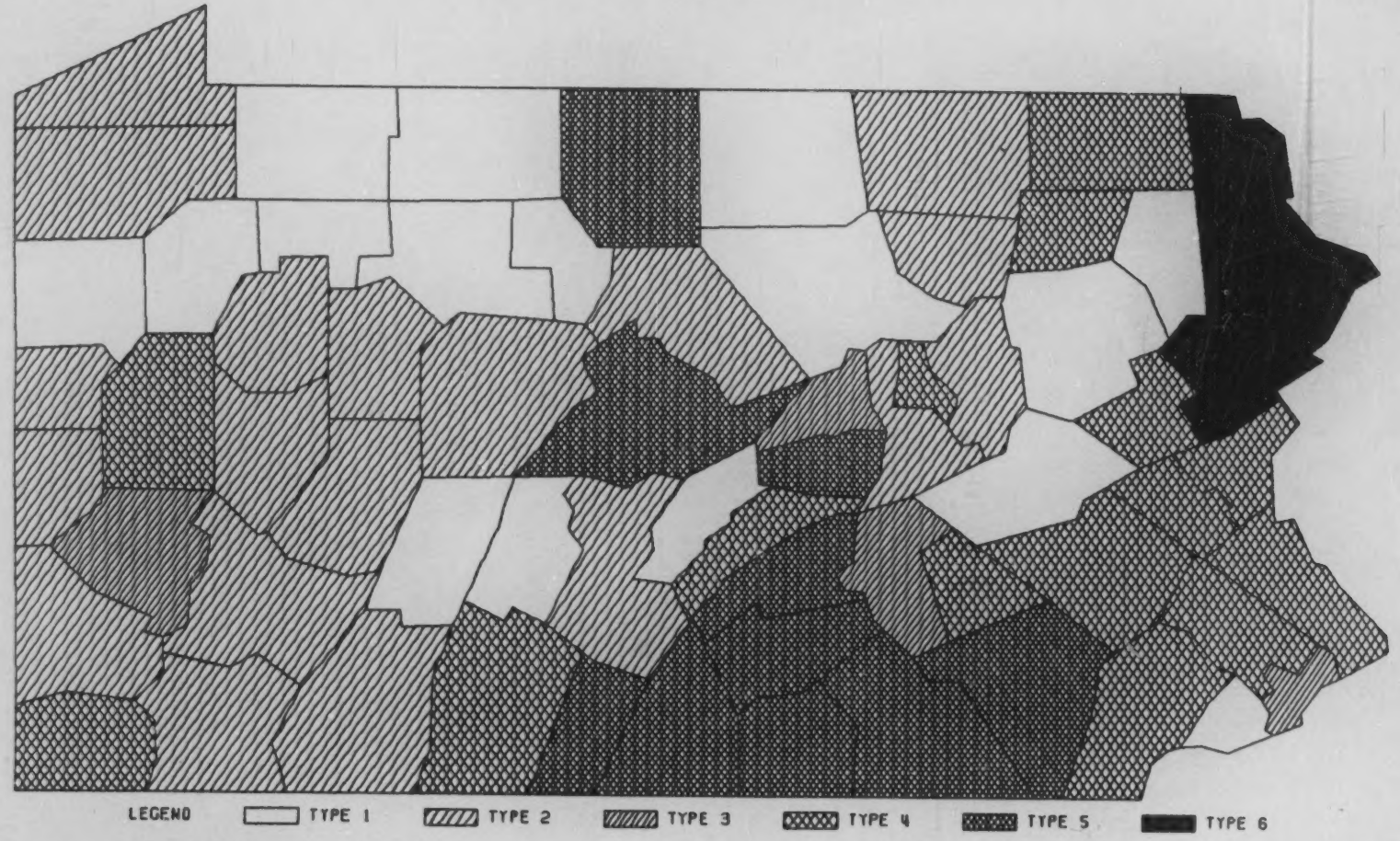
2. Gladys K. Bowles and Everett S. Lee, Net Migration of the Population, 1960-1970, by Age, Sex and Color. Part 1, Athens, GA: University of Georgia, and U.S. Department of Commerce, 1975.

3. U.S. Bureau of the Census, 1980 Census of Population, Gross Migration for Counties, 1975 to 1980. Supplementary Report. No. PC80-S1-17, March, 1984. U.S. Government Printing Office, Washington, D.C.

4. Extrapolation for 1985 based on preliminary Census Bureau 1984 population estimates for Pennsylvania Counties. Pennsylvania State Data Center.

Figure 1

COUNTY NET MIGRATION TYPOLOGY
FOR PPPES POPULATION PROJECTIONS
1985 TO 2000



TYPE 1 = CONTINUING LOW REDUCTION IN NET OUT-MIGRATION RATES
TYPE 2 = SLOW REDUCTION IN NET OUT-MIGRATION RATES
TYPE 3 = RAPID REDUCTION IN NET OUT-MIGRATION RATES
TYPE 4 = LOW DECLINING RATES OF NET IN-MIGRATION
TYPE 5 = LOW NET IN MIGRATION RATES CONTINUING
TYPE 6 = HIGH NET IN MIGRATION RATES CONTINUING

PSDC Statistical Graphics

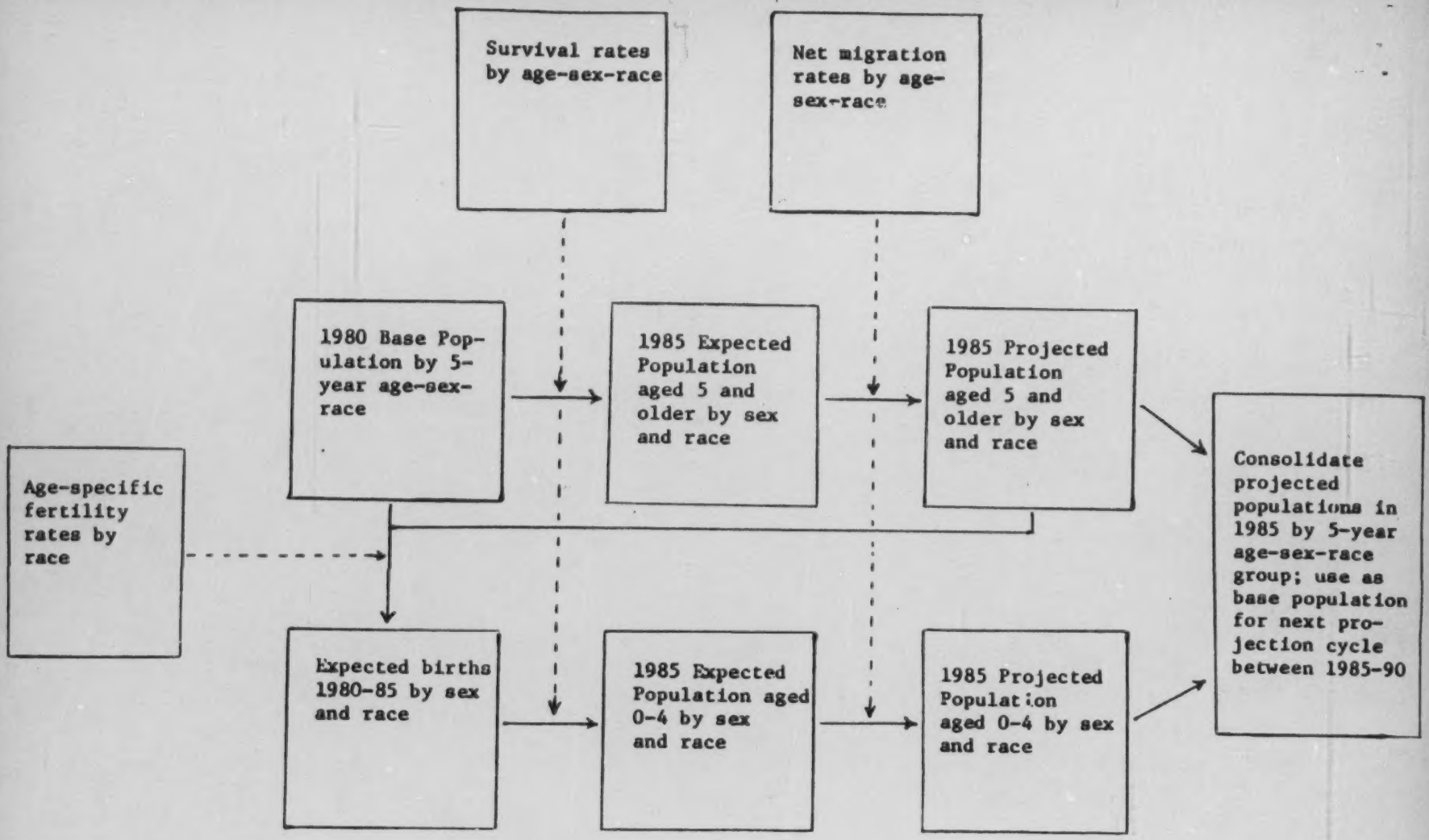

Survival rates by age-sex-race
Net migration rates by age-sex-race
1980 Base Population by 5-year age-sex-race
1985 Expected Population aged 5 and older by sex and race
1985 Projected Population aged 5 and older by sex and race
Age-specific fertility rates by race
Consolidate projected populations in 1985 by 5-year age-sex-race group; use as base population for next projection cycle between 1985-90
Expected births 1980-85 by sex and race
1985 Expected Population aged 0-4 by sex and race
1985 Projected Population aged 0-4 by sex and race

Figure 2. Flow Diagram of Cohort Component Projection Model

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FERTILITY IN PENNSYLVANIA: 1960-2000

by

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FERTILITY IN PENNSYLVANIA: 1960 - 2000

SUMMARY

This paper is an analysis of fertility patterns in the United States, Pennsylvania, and its sixty-seven counties for the period from 1960 to 1980. From this analysis, projected fertility rates are developed for white and nonwhite women in Pennsylvania for 1985 to 2000. Findings include:

* Fertility declined by about fifty percent from 1960 to 1980 in both the United States and Pennsylvania.

* Pennsylvania women have consistently lower fertility levels than all women in the United States.

* Based on past differentials between state and national fertility rates, it is expected that fertility rates in Pennsylvania will increase slightly until 1990 and then remain stable until 2000.

* At all geographical levels, nonwhite women have higher fertility rates than white women but have experienced the same trends in fertility as white women.

* County level fertility rates vary widely in Pennsylvania but, in general, the rates in metropolitan counties are lower than in nonmetropolitan counties.

The historical pattern of lower fertility rates in Pennsylvania than in the nation as a whole is expected to continue. The availability of educational and occupational opportunities for women in Pennsylvania is an indication that the delayed childbearing practices in the state are likely to continue. This will result in lower fertility levels than those of all women in the United States.

INTRODUCTION

In any set of population projections, assumptions about the future course of vital rates are required for the population projection period. These expected rates can be determined through an analysis of past trends; through the use of some accepted methodology; or through the knowledge of the theory of determinants of future fertility levels. In Pennsylvania, analyses of past Pennsylvania trends are integrated with the U.S. Bureau of the Census projected future patterns as the principal determinant of future Pennsylvania fertility patterns.

In the U.S., fertility rates have been declining steadily since the beginning of this century. Although the baby boom was a period of increased fertility relative to the preceding fifteen years, a smooth curve drawn to illustrate fertility rates would show a steady decline until the late 1970's. Since then, the fertility rate has remained relatively low or may have increased very slightly.

The Census Bureau has projected fertility rates in the United States for whites and nonwhites for the next century. These rates are projected from data on the expected fertility of currently fertile women and from a variety of theoretical models for the remaining years of the projections. Unless fertility conditions change dramatically, these rates should be reasonably accurate for the next fifteen years.

This schedule of projected rates can be adapted for Pennsylvania fertility projections through a comparison of the historic differentials between U.S. rates and Pennsylvania rates. The purpose of this paper is to analyze the relationship between Pennsylvania and national differences in fertility rates. This analysis is then used to base assumptions on how fertility rates will change in Pennsylvania and its counties between 1985 and 2000.

This analysis focuses on the relationship of Pennsylvania rates to national rates for 1960, 1970, and 1980. The national fertility rates have been adjusted for an assumed undercount in each of these censuses (U.S. Bureau of the Census, 1984). The state rates have not been adjusted for either undercounts or overcounts because the corrections for 1980 for each state are not available. The 1980 female population counts in Pennsylvania have been corrected for the underreporting in race categories. There is likely little difference between the true and calculated rates in Pennsylvania because the counts of women of reproductive ages are fairly accurate.

White Fertility Trends.

The comparison of national and state **Age-Specific Fertility Rates (ASFR's)** for whites in Table 1 shows that since 1960, state ASFR's generally have been lower than the comparable national rates. Three ASFR's in 1970 and one ASFR in 1960 were higher than the comparable national rate but the remainder in those years and all of the 1980 ASFR's were lower than the national rates. Generally, the state rates in the age groups from 20 to 34 tended to be close to the national rates and the rates for the young and the old cohorts tended to be quite divergent from the national rates.

The Total Fertility Rate (TFR) in Pennsylvania is consistently below the national rate (Table 1). The TFR indicates the average number of children women would bear given the period specific ASFR's. In 1960, Pennsylvania women had about .22 fewer children per woman than did women nationally. By 1980, Pennsylvania women had about .15 fewer children per woman than did all the women in the country.

The declines in ASFR's from 1960 to 1980 were similar in both the U.S. and Pennsylvania. Much of the decline in fertility was to women in the prime

fertility ages. For example, the fertility rate of women 20 - 24 declined from 225.5 births per 1000 women in 1960 in Pennsylvania to 92.8 in 1980. The 1980 rate for the 25 - 29 and the 30 - 34 age groups also declined to about one-half of the 1960 rates.

One consistent difference between Pennsylvania and U.S. ASFR's has been among the 20 - 24 age group. While the 25 - 29 and 30 - 34 age groups in Pennsylvania have experienced about the same fertility levels as the U. S. and Pennsylvania, the 20 - 24 age group in Pennsylvania has had a much lower fertility rate than national women.

Until 1980, the 20 - 24 age group was the most fertile. As a result, the difference in TFR's between Pennsylvania and the U.S. was principally due to a much lower fertility rate among women in the 20 - 24 age group in Pennsylvania. If in 1980, the ASFR for women aged 20 -24 had been the same in Pennsylvania as nationally, then the TFR in Pennsylvania would have increased from 1.59 to 1.67. The difference in this age group alone accounts for more than one-half of the difference in Pennsylvania and national TFR's. The fertility pattern for Pennsylvania reflects delayed childbearing.

Some demographic theorists have proposed that the availabilty of educational and occupational opportunities results in lower fertility. From this perspective, the data for Pennsylvania indicate little evidence for a return to the high fertility rates of the 1960's.

Nonwhite Fertility Trends.

The analysis of nonwhite fertility rates[1] differs from whites in two ways. First, nonwhite fertility is most important for those counties in Pennsylvania where there are greater than 5,000 nonwhites and for the state nonwhite fertility rates. Second, the dominant influence on national black fertility rates is the childbearing experience of rural southern blacks. In Pennsylvania, most nonwhites are in metropolitan counties. The analysis of state and national differences and the relationship to projected rates must be cognizant of these differences.

Table 2 contains 1960, 1970, and 1980 Pennsylvania and national ASFR's for nonwhites. The 1960 national ASFR's are for all nonwhites. The 1970 and the 1980 national rates are for blacks and have been corrected for net enumeration errors and estimated birth registration errors. All Pennsylvania rates are for total nonwhites and have not been corrected for enumeration or birth registration errors, except for a correction for the mis-reporting of race in the 1980 Census. These data must be interpreted carefully since there are 1) composition and location differentials between Pennsylvania and U.S. women; 2) differences in rates between blacks and other nonwhite groups; and 3) differences in data corrections for each group.

Overall, the TFR's of nonwhite women[2] are higher than white rates in each of the time periods. This difference, though, has diminished over the twenty year period. Nationally, in 1960, nonwhites had about .73 more children per woman than whites, but by 1980, this difference was only .53 children. A similar pattern occured in Pennsylvania.

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1. Blacks are roughly estimated to be at least 93 percent of the nonwhite population in Pennsylvania in 1980.
2. Throughout this analysis, nonwhite fertility rates are assumed to be represented by black rates where no nonwhite rates are available.

The overall higher nonwhite fertility does not occur in every age group. The prinicipal difference in white/nonwhite fertility is among women in the 15 - 24 age groups. For example, in 1980, the national ASFR for nonwhite women aged 15 - 19 was more than double the white rate and the nonwhite rate for women 20 -24 was one-third higher than the white rate. In contrast, the rates for white women age 25 - 29 are slightly higher than nonwhite women, especially in Pennsylvania. Race differences likely result, in part, from differences in educational and occupational opportunities.

The nonwhite fertility trends do not differ from those of whites. Nationally, since 1960 there has been a steady decline in the TFR of nonwhite women. White fertility decreased about 50 percent and nonwhite fertility decreased about 47 percent from 1960 - 1980. In absolute terms, whites were having about 177 fewer births per 1000 women in 1980 than in 1960 and nonwhites were having about 197 fewer births. In Pennsylvania, whites were having about 170 fewer births while nonwhites were having about 200 fewer over this time period.

As with whites, the fertility of nonwhite women in Pennsylvania is lower than comparable U.S. rates. In each time period, the Pennsylvania TFR is lower than the national and this difference is increasing. In 1970, nonwhite women nationally were having about twelve more births per 1000 women than in Pennsylvania but by 1980, this difference had increased to 22 births. Overall, these data indicate a relatively rapid decrease in nonwhite fertility in Pennsylvania.

Since about three-fourths of all births occur to women whose ager are between 15 and 30, it is most useful to concentrate on the analysis of state and national differences in these ages. In both 1960 and 1970, the ASFR's of nonwhite

women 15 - 24 were higher than for all nonwhite women in the country. This was opposite of the pattern among white women in this period. By 1980, nonwhite women in Pennsylvania had lower fertility rates than the national rates in these age groups. If lower fertility among young women is correlated with the improvement of the status of women, the evidence from Pennsylvania is that nonwhite women were gainers in the 1970 - 1980 period. In the 25 - 29 age group, Pennsylvania nonwhite fertility has consistently been lower than the national rate.

An interesting comparison can be made between white and nonwhite ASFR's for these age groups. The nonwhite rate among women aged 15 - 24 has been much higher than the white rate but this difference is converging. The difference in the 15 - 24 age rates explains much of the higher TFR of nonwhite women. In contrast, the fertility rate of white women 25 - 29 has been higher than the nonwhite rate. This is the only age group where such a reversal occured, except for the 30 -34 women in Pennsylvania in 1980.

In sum, fertility has been declining among both whites and nonwhites since 1960 and relatively more in Pennsylvania than in the entire country. Much of the decline has been among women 15 - 24. There is some evidence to indicate that the proportion of all births has increased among women above 25 years. In 1980, there is no age group where fertility is higher among Pennsylvania women than all U. S. women. These trends and differentials in the context of theories on fertility suggest that Pennsylvania fertility will remain lower than the nation in the near term future.

FERTILITY PROJECTION STRATEGIES

There are three primary options for projecting fertility rates based on the rate schedules made available from the Census Bureau. First, one of the projected rate schedules could be adopted without any changes. Most states base their projections on the Census Bureau's middle fertility series. These states do not alter the rates to reflect state or local differences. Second, the 1980 Pennsylvania rates could be converged to the national rates over some time period. Third, the Pennsylvania rates could be projected as a proportion of the nationally projected rates.

White Projections.

The first possible option for projecting Pennsylvania rates is the Census Bureau's low fertility series. This series projects the national TFR to drop to 1.63 by 2000. This option can be considered because Pennsylvania women have lower fertility than all U.S. women but, as can be seen from Tables 1 and 2, the Pennsylvania ASFR's are not consistently below the national rates. Only if every Pennsylvania ASFR were below the respective national ASFR would it be safe to argue that lower U.S. Bureau of the Census series is warranted.

A second option is to use, as many state projections do, the U.S. Bureau of the Census middle series without making any adjustments for state/national differentials. This option is not adopted principally because of the trends and differentials in the 20 - 24 age cohort. Since the 25 - 29 and the 30 - 34 cohorts, have been consistently close to the national rates, the primary reason that the Pennsylvania TFR has been below the national TFR is the difference in the fertility experience of the 20 - 24 cohort. If in 1980, the 20 - 24 cohort in Pennsylvania experienced the same fertility as the national cohort, there would

have been a five percent increase in births in Pennsylvania. Given the additional error that comes from the less active cohorts, the use of the unadjusted U.S. Bureau of the Census middle series would produce high birth projections.

A third option is to converge the Pennsylvania rates to the middle series over some time period. This option is not recommended because there is no evidence that the rates are converging. The data in Tables 1 and 2 indicate that the Pennsylvania rates are decreasing relative to the national rates.

The next option is to diverge the Pennsylvania rates relative to the national rates since this is indicated by the 1960-1980 data. However, this option does not seem reasonable because it is unlikely that there will be an increase in the differences between Pennsylvania and the remainder of the country. The literature on long-term trends in fertility differentials does not support increasing differentials of this type.

A final option, and the one adopted here, is to use the U.S. Bureau of the Census middle series as a long-term target but to adjust the Pennsylvania ASFR's to some proportion of the projected series. This strategy is used by the Census Bureau in making its state population projections. Given the preceeding analysis of Pennsylvania/U.S. trends and differentials in fertility, the ratio of Pennsylvania to U. S. ASFR's in 1980 represents a most likely differential in fertility for the 1985 to 2000 projection series. By using these proportions, the fertility of Pennsylvania women remains somewhat lower than all U.S. women but the differences in ASFR's between Pennsylvania and U.S. women is maintained. At the same time, it does not permit the Pennsylvania rate to diverge from the national rate.

Table 3 contains the middle series of white ASFR's projected by the Census Bureau for 1985 to 2000. This series projects the white TFR to increase

from 1.74 in 1980 to 1.9 by 2000. There is little change expected in the two youngest and oldest age cohorts over this span. The 20 - 24 age cohort is expected to slightly increase its fertility and the 25 - 39 cohorts are expected to increase much more. These rates reflect an anticipated increase in delayed childbearing. The 30 - 34 cohort is expected to experience the greatest increase in rates and is the only cohort where the projected rates are greater than the 1970 rates.

Table 4 contains the projected fertility rates for Pennsylvania from 1985 through 2000 based on the ratio of the 1980 Pennsylvania to U.S. fertility differentials. These rates predict that the TFR for Pennsylvania will increase to about 1.76 in 1990 and hold steady from then until 2000. These rates show an increase in fertility among all white women in the 20 - 39 age groups and especially among the older groups. Unlike the national rates, none of these projected rates is above the comparable 1970 rate.

One problem with the strategy of maintaining proportions is the fertility rates of the 35 - 39 age groups. In 1980, the Pennsylvania rate for this group was 90 percent of the national rate but in 1970 and 1960, it was much closer to the national rate. Even though fewer than four percent of the births came to mothers in this age group in 1980, this age group is expected to produce an increasing proportion of births. Given what we know about the trends in delayed childbearing and the possibility that the 1980 data may not reflect the actual relationship between Pennsylvania and the U.S. for this age group, and thus, the fertility rates for this age group might be somewhat underestimated in Pennsylvania.

Nonwhite Projections.

The options for projecting nonwhite fertility rates are the same as those for whites. Based on the preceeding data analysis, the most viable option is that used for projecting white fertility - maintaining the ratio of the 1980 Pennsylvania to U.S. ASFR's and basing the projected rates on the Census Bureau's projected middle fertility schedule for nonwhites. This is the most viable option, not only because it provides consistency, but also because the analysis of the past rates shows it best describes the Pennsylvania and U. S. differentials.

Table 5 contains the middle series of projected national ASFR's for black women. Except for the 25 - 29 age groups, the rates are higher than the white rates. The Census Bureau had assumed some convergence to the white rates which is reflected in a TFR of 2.29 in 2000. The projected rates for those below age 25 are much higher for blacks than for whites, but the white rates are higher in 25 - 29 age group. There is a fairly substantial decline projected for black women in the 15 - 19 age group.

The Census Bureau projects only the fertility rates for black women, not for nonwhite women. Since the 1980 data are for U.S. black women and Pennsylvania nonwhite women, the projected rates in Table 6 are derived from the ratio of Pennsylvania nonwhite fertility rates to U.S. black fertility rates. The projected TFR's for Pennsylvania women increase from 2.05 in 1980 to 2.13 in 1990 and then drops to 2.08 in 2000. The increase is based on the expected increase in fertility by 1990 according to the Census Bureau and the decrease by 2000 results from the convergence to white fertility rates that are expected by the Census Bureau. The fertility rates of women 25 -39 are expected to increase while the rates for women under 25 are expected to decrease; especially among those women aged 15 - 19.

In the period from 1980 to 2000, the number of women in the prime childbearing ages (15 - 29) is expected to decline. Since there is no projected increase in the respective ASFR's, it can be expected that the number of births will decrease throughout this period assuming the projected rates. This decline will be tempered somewhat with an increase in older women whose fertility is expected to increase, although not substantially.

COUNTY FERTILITY PATTERNS IN PENNSYLVANIA

Not only does fertility differ between the entire country and Pennsylvania, but there are differences between the state and each county in fertility levels. This section focuses on these differences so that births in each county can be accurately projected. The analysis is similar to the analysis of Pennsylvania and U.S. fertility.

County Fertility Data.

The measurement of fertility becomes more problematic as the size of an area diminishes. At the level of counties, there are a number of problems associated with fertility analysis, principal of which is the potential for large variations from year to year in fertility. There are other problems with registration, enumeration, and errors in age reporting. In this analysis, it is assumed that the county reported is the county of residence of the mother.

In counties with small populations, there are many possibilities for errors in the computation of ASFR's. Births happen throughout the year but the county of residence is recorded as of April 1 for the Census. Similarly, the age of the mother is recorded as of April 1 but the birth may occur when the mother is a year younger or older. An accurate ASFR requires that the age of the mother be recorded and transcribed accurately through both the census processing and the vital statistics data processing. Many errors result from all of these procedures, so that distortions of ASFR's could result in small area calculations.

For purposes of projections, the Census Bureau recommends that a **Modified General Fertility Rate (MGFR)** be used to project births for small areas. This rate is calculated as the number of births in an area divided by the number of women aged 20 -34. Census Bureau analysts argue that women in these ages

are most likely to have correctly and completely recorded information in the Census.

The following analysis of the relationship of county to state fertility is based on MGFR's. Again, three decennial census dates are used because of the census population bases. The birth data are those described in the first part of this paper.[3]

Table 7 demonstrates the relationship between the MFGR and a more complete fertility measure, the TFR. The purpose of this comparison is to determine if the relationship between county and state fertility can be accurately measured by the MFGR. If the ratio is relatively similar, then the more simple Census Bureau recommended projection measure, the MGFR, can be used in the analysis as well as the projections.

The data presented include the MGFR's, the TFR's for the state and ten sample counties for the three decennial years. In both 1970 and 1980, the ratios between the state and the counties are almost the same with both measures. In 1960, when there was limited data, there are some differences, but too few to warrant a conclusion that the MGFR is unreliable as a measure used to analyze the trends and differentials in the county and state fertility.

Tables 8 and 9 contain the white and nonwhite MGFR's, respectively, for each county for the three decennial years as well as the ratio of each county MGFR to the state MGFR. The nonwhite data in Table 9 are only for those counties with a sufficiently large nonwhite population that reasonable data are available. While these data are informative of differences between counties, there is no conclusive evidence of any divergence or convergence between county

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3. Three years of births are averaged around 1970 and 1980 but only one year of births is available in 1960. This lack of data in 1960 makes the county data in this period somewhat unreliable.

and state fertility levels.

The fertility patterns in each county reflect the national and state patterns described earlier. Over the twenty year period, fertility declined in all counties. The MGFR's in 1980 are about one-half of those in 1960. In all counties, nonwhite fertility is higher than white fertility.

In Charts 1 and 2, the ratios of county to state MGFR's in 1970 and 1980 are presented. The 1960 data are not used because of the questionable value of one year birth data for county comparisons. These data show that most counties are consistently either above or below the state fertility levels. Centre County has the lowest ratio in 1980 which reflects the college age population. In general, though, most counties are within 25 percent of the state fertility level.

There does appear to be some differences between metropolitan and nonmetropolitan counties. Using the latest Office of Management and Budget designation of metropolitan counties shows that most counties with larger central cities (Philadelphia, Allegheny, and Dauphin) have lower fertility than the state level, and most of the larger suburban counties are also below the state fertility level. The only nonmetropolitan counties which experienced fertility levels below the state level were Indiana, Pike, and Union. Many of the smaller central city counties such as Erie, Lycoming, and Lancaster have higher fertility rates than the state.

In 1980, about 27 percent of all of the births in the state were to women who lived in Philadelphia or Allegheny counties. As such, the fertility of these counties principally determines the state level of fertility. These two counties have some of the lowest white fertility levels in the state, so that the remainder of the state is somewhat relative to these counties. Three of the four counties in the Pittsburgh PMSA and all of the counties of the Philadelphia PMSA except

Bucks experienced lower fertility than the state as a whole. In general, the Northern Tier counties and the south central counties had the highest fertility levels.

The analysis also focuses on whether counties were converging to state fertility levels or if there was some other pattern that described the trends in county fertility. While the fertility levels for each of the counties are similar to those described for the state in the earlier part of this report, there is no consistent evidence that counties are either converging or diverging as a trend.

Since the data do not indicate a trend, for either whites or nonwhites, the 1980 county to state ratio of MGFR's will be used to project changing county fertility levels. Based on the data presented, errors with this technique are not likely to be substantial because the lower fertility rates in the counties already below the state rate are likely to continue and not become increasingly lower than the state rate. Similarly, the counties with higher rates are likely to remain so. Because there are relatively few births in these counties, it would be necessary for their county to state ratio to change substantially in order to dramatically alter the projections of births in each county.

Table 1: Age-Specific and Total Fertility Rates for Pennsylvania and the U. S. and Their Ratios; White Women: 1960, 1970, and 1980.

AGE	1960 PA	1960 US	1960 RATIO	1970 PA	1970 US	1970 RATIO	1980 PA	1980 US	1980 RAT
<15	0.2	0.7	0.29	0.2	0.7	0.37	0.3	0.8	0.4
15-19	57.5	82.5	0.70	41.9	59.0	0.71	33.8	44.9	0.75
20-24	225.5	242.6	0.93	146.2	158.6	0.92	92.8	109.2	0.85
25-29	195.1	194.6	1.00	146.9	139.7	1.05	110.9	110.9	1.00
30-34	111.3	110.6	1.07	74.4	70.6	1.05	59.3	59.6	1.01
35-39	53.9	54.7	0.99	31.7	30.4	1.05	17.0	18.7	0.91
40-44	13.5	15.1	0.89	7.4	7.9	0.94	2.9	3.6	0.82
45+	0.7	0.9	0.86	0.4	0.4	1.00	0.1	0.2	0.50
TFR	3.29	3.51	0.94	2.25	2.34	0.96	1.59	1.74	0.91

NOTES: Pennsylvania ASFR's in 1970 and 1980 are based on three year averages of births.
U.S. fertility rates are from U.S. Bureau of the Census (1984) Table A-5.
Pennsylvania births obtained from Pennsylvania State Health Data Center.
1980 Pennsylvania population from counts corrected for underreporting of race.
Women aged 10-14 and 44-49 are the denominators for the categories of <15 and 45+, respectively.

Table 2: Age-Specific and Total Fertility Rates for Pennsylvania and the U.S. and Their Ratios; Nonwhite Women: 1960, 1970, and 1980.

AGE	1960			1970			1980		
	PA	US	RATIO	PA	US	RATIO	PA	US	RATIO
<15	4.0	4.3	0.93	4.7	5.4	0.88	3.7	4.4	0.84
15-19	161.1	146.6	1.11	139.1	138.1	1.01	89.4	100.8	0.89
20-24	276.1	267.6	1.03	190.5	188.9	1.01	134.0	146.2	0.92
25-29	187.4	203.4	0.81	122.3	125.7	0.97	102.3	108.4	0.94
30-34	111.5	130.0	0.76	69.0	76.1	0.91	57.8	62.3	0.94
35-39	55.0	72.2	0.76	31.6	41.5	0.76	19.1	25.2	0.76
40-44	15.5	21.8	0.71	8.2	12.8	0.64	3.5	6.2	0.57
45+	1.0	1.9	0.53	0.3	1.1	0.27	0.3	0.5	0.60
TFR	4.06	4.24	0.96	2.83	2.95	0.96	2.05	2.27	0.90

NOTES: Pennsylvania fertility rates in 1970 and 1980 are based on three year averages of births.
U.S. fertility rates are from U.S. Bureau of the Census (1984) Table A-6.
Pennsylvania births from Pennsylvani State Health Data Center.
1980 Pennsylvania population from counts corrected for underreporting of race.
Women 10-14 and 45-49 are the denominators for the rates calculated for <15 and 45+, respectively.

Table 3: Projected National Age-Specific Fertility Rates for White Women: 1985, 1990, 1995, 2000 (Middle Series).

AGE-SPECIFIC FERTILITY RATES

AGE	1985	1990	1995	2000
<15	0.8	0.8	0.7	0.7
15-19	45.0	45.0	44.9	44.9
20-24	109.9	110.8	111.8	112.6
25-29	115.7	119.2	119.8	120.4
30-34	65.2	73.7	74.7	74.0
35-39	19.8	21.4	23.0	23.1
40-44	3.6	3.6	3.6	3.6
45+	0.2	0.2	0.2	0.2
TFR	1.80	1.87	1.89	1.90

NOTE: ASFR's from U.S. Bureau of the Census (1984) Table A-5.

Table 4: Projected Fertility Rates for White Women in Pennsylvania: 1985 - 2000.

AGE-SPECIFIC FERTILITY RATES

AGE	1985	1990	1995	2000
<15	0.3	0.3	0.3	0.3
15-19	33.8	33.8	33.8	33.3
20-24	93.4	94.2	95.0	95.7
25-29	115.7	119.2	119.8	120.4
30-34	64.9	73.3	74.3	73.6
35-39	18.0	19.5	20.9	21.0
40-44	3.0	3.0	3.0	3.0
45+	0.1	0.1	0.1	0.1
TFR	1.66	1.73	1.75	1.75

NOTE: These ASFR's are the product of the ratio of 1980 PA /U.S. ASFR's and the Middle Series of projected fertility rates from the Census Bureau.

Table 5: Projected National Age-Specific Fertility Rates for Nonwhite Women: 1985, 1990, 1995, 2000 (Middle Series).

AGE	AGE-SPECIFIC FERTILITY RATES			
	1985	1990	1995	2000
<15	4.2	3.7	3.3	3.0
15-19	98.5	94.2	89.8	85.5
20-24	145.5	143.9	142.4	140.7
25-29	113.0	116.6	117.4	118.3
30-34	68.0	76.6	77.4	76.5
35-39	26.3	27.9	29.3	28.9
40-44	6.0	5.8	5.7	5.5
45+	0.3	0.3	0.3	0.2
TFR	2.31	2.35	2.33	2.29

NOTE: Fertility rates from U.S. Bureau of the Census (1984); Table A-6.

Table 6: Projected Fertility Rates for Non-White Women in Pennsylvania; 1985 - 2000.

AGE-SPECIFIC FERTILITY RATES

AGE	1985	1990	1995	2000
<15	3.5	3.1	2.8	2.5
15-19	87.4	83.6	79.7	75.8
20-24	133.4	132.0	130.6	128.4
25-29	106.7	110.1	110.8	111.7
30-34	64.2	72.3	73.1	72.2
35-39	19.9	21.1	22.2	21.9
40-44	3.3	3.3	3.3	3.1
45+	0.2	0.2	0.1	0.1
TFR	2.09	2.13	2.11	2.08

NOTE: These ASFR's are the product of the ratio of 1980 PA /U.S. ASFR's and the Middle Series of projected fertility rates from the Census Bureau.

TABLE 7: A Comparison of Modified General Fertility Rates, Total Fertility Rates, and Their Ratio to State Rates for Ten Pennsylvania Counties (Whites only): 1960, 1970, and 1980.

	1960				1970				1980			
	MGFR	RATIO	TFR	RATIO	MGFR	RATIO	TFR	RATIO	MGFR	RATIO	TFR	RATIO
PENNSYL'IA	223		3.29		158		2.25		107		1.59	
ADAMS	231	1.03	3.35	1.02	177	1.12	2.43	1.08	113	1.05	1.66	1.04
BLAIR	236	1.06	3.41	1.04	182	1.15	2.75	1.22	122	1.14	1.72	1.08
ALLEGHENY	222	0.99	3.22	0.98	146	0.91	2.06	0.92	91	0.85	1.39	0.87
DAUPHIN	217	0.97	3.23	0.98	149	0.94	2.08	0.92	99	0.92	1.51	0.95
BUTLER	253	1.13	3.71	1.13	166	1.04	2.34	1.04	112	1.05	1.67	1.05
BEDFORD	285	1.28	4.11	1.25	201	1.27	2.82	1.25	123	1.14	1.92	1.21
MONTGOMERY	227	1.02	3.27	0.99	147	0.93	2.14	0.95	100	0.93	1.51	0.94
NORTH'PTON	201	0.90	3.01	0.91	150	0.94	2.07	0.92	102	0.95	1.52	0.96
CARBON	208	0.93	3.42	1.04	180	1.13	2.49	1.11	115	1.07	1.87	1.18
CLEARFIELD	240	1.07	3.09	0.94	199	1.25	2.83	1.26	131	1.22	1.71	1.08

Table 8: County Modified General Fertiltiy Rates and Their Ratio to the State Modified General Fertility Rate for Whites: 1960, 1970, 1980.

COUNTY	1960 MGFR	1960 RATIO	1970 MGFR	1970 RATIO	1980 MGFR	1980 RATIO
PENNSYLVANIA	223		158		107	
ADAMS	232	1.04	177	1.12	113	1.06
ALLEGHENY	222	0.99	146	0.92	91	0.85
ARMSTRONG	230	1.03	182	1.15	121	1.13
BEAVER	223	1.00	155	0.98	110	1.03
BEDFORD	236	1.06	202	1.27	123	1.15
BERKS	204	0.91	146	0.92	109	1.02
BLAIR	236	1.06	182	1.15	122	1.14
BRADFORD	286	1.28	201	1.27	133	1.24
BUCKS	240	1.08	170	1.07	111	1.04
BUTLER	253	1.13	165	1.04	112	1.05
CAMBRIA	237	1.06	185	1.16	113	1.06
CAMERON	243	1.09	191	1.20	132	1.23
CARBON	208	0.93	180	1.13	115	1.08
CENTRE	195	0.87	132	0.83	68	0.64
CHESTER	231	1.03	144	0.91	105	0.99
CLARION	251	1.12	173	1.09	115	1.08
CLEARFIELD	240	1.07	199	1.26	131	1.22
CLINTON	229	1.02	165	1.04	120	1.12
COLUMBIA	224	1.00	163	1.03	126	1.17
CRAWFORD	239	1.07	178	1.12	123	1.15
CUMBERLAND	223	1.00	146	0.92	93	0.87
DAUPHIN	217	0.97	148	0.94	99	0.92
DELAWARE	216	0.97	153	0.96	104	0.97
ELK	258	1.15	316	2.00	138	1.29
ERIE	251	1.12	188	1.19	118	1.10
FAYETTE	233	1.05	197	1.24	122	1.14
FOREST	254	1.14	161	1.02	111	1.04
FRANKLIN	212	0.95	173	1.09	113	1.06
FULTON	193	0.87	172	1.09	128	1.20
GREENE	218	0.97	194	1.22	117	1.09
HUNTINGDON	211	0.94	196	1.24	118	1.10
INDIANA	235	1.05	156	0.99	105	0.98
JEFFERSON	234	1.05	180	1.13	134	1.26
JUNIATA	235	1.05	185	1.17	135	1.26
LACKAWANNA	203	0.91	160	1.01	107	1.00
LANCASTER	235	1.05	164	1.03	123	1.15
LAWRENCE	216	0.97	160	1.01	112	1.04
LEBANON	240	1.07	164	1.03	115	1.08
LEHIGH	204	0.92	122	0.77	101	0.94
LUZERNE	201	0.90	160	1.01	105	0.98
LYCOMING	254	1.14	194	1.22	124	1.16
MCKEAN	256	1.15	203	1.28	132	1.23
MERCER	230	1.03	166	1.05	109	1.02
MIFFLIN	234	1.05	189	1.19	121	1.13
MONROE	218	0.98	154	0.97	97	0.91
MONTGOMERY	220	0.99	147	0.93	100	0.93

MONTOUR	208	0.93	288	1.81	118	1.10
NORTHAMPTON	201	0.90	150	0.95	102	0.95
NORTHUMBERLAND	210	0.94	171	1.08	118	1.10
PERRY	225	1.01	181	1.13	124	1.16
PHILADELPHIA	213	0.95	143	0.90	99	0.92
PIKE	270	1.21	170	1.07	105	0.98
POTTER	283	1.27	222	1.34	153	1.43
SCHUYLKILL	200	0.90	179	1.13	116	1.08
SNYDER	204	0.91	159	1.00	109	1.02
SOMERSET	229	1.03	187	1.18	124	1.16
SULLIVAN	288	1.29	199	1.25	129	1.21
SUSQUEHANNA	276	1.24	212	1.28	134	1.25
TIOGA	281	1.26	167	1.05	122	1.14
UNION	171	0.77	146	0.92	102	0.95
VENANGO	223	1.00	173	1.09	119	1.11
WARREN	230	1.03	171	1.08	127	1.19
WASHINGTON	216	0.97	165	1.04	104	0.98
WAYNE	249	1.12	206	1.30	140	1.30
WESTMORELAND	215	0.96	161	1.02	102	0.96
WYOMING	251	1.12	225	1.42	125	1.17
YORK	228	1.02	168	1.06	101	0.95

TABLE 9: County Modified General Fertility Rates and Their Ratio to the State Modified General Fertility Rates for Nonwhites: 1960, 1970, 1980. (Counties with more than 5000 nonwhites in 1980)

COUNTY	1960		1970		1980	
	MGFR	RATIO	MGFR	RATIO	MGFR	RATIO
PENNSYLVANIA	268		212		134	
ALLEGHENY	268	1.00	220	1.04	136	1.01
BEAVER	285	1.06	246	1.16	172	1.28
BERKS	316	1.18	318	1.15	196	1.46
BUCKS	310	1.15	216	1.02	142	1.06
CHESTER	342	1.28	220	1.04	132	0.98
DAUPHIN	306	1.14	317	1.50	167	1.25
DELAWARE	256	0.95	220	1.04	136	1.01
ERIE	381	1.42	368	1.74	190	1.41
FAYETTE	350	1.31	316	1.49	162	1.21
LANCASTER	332	1.34	490	2.31	184	1.37
MERCER	267	1.00	257	1.21	184	1.37
MONTGOMERY	227	0.84	194	0.92	140	1.04
PHILADELPHIA	259	0.97	199	0.94	140	1.04
WASHINGTON	291	1.09	288	1.36	150	1.12
WESTMORELAND	305	1.14	222	1.05	161	1.20
YORK	328	1.22	270	1.27	184	1.37

REFERENCES

1984 U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 952, Projections of the Population of the United States, by Age, Sex, and Race: 1983 - 2000. GPO; Washington.

CHART 1: RATIO OF COUNTY TO STATE MODIFIED GENERAL FERTILITY RATES: 1970, 1980. (WHITES)

1970 - Top
1980 - Bottom

COUNTIES OF PENNSYLVANIA

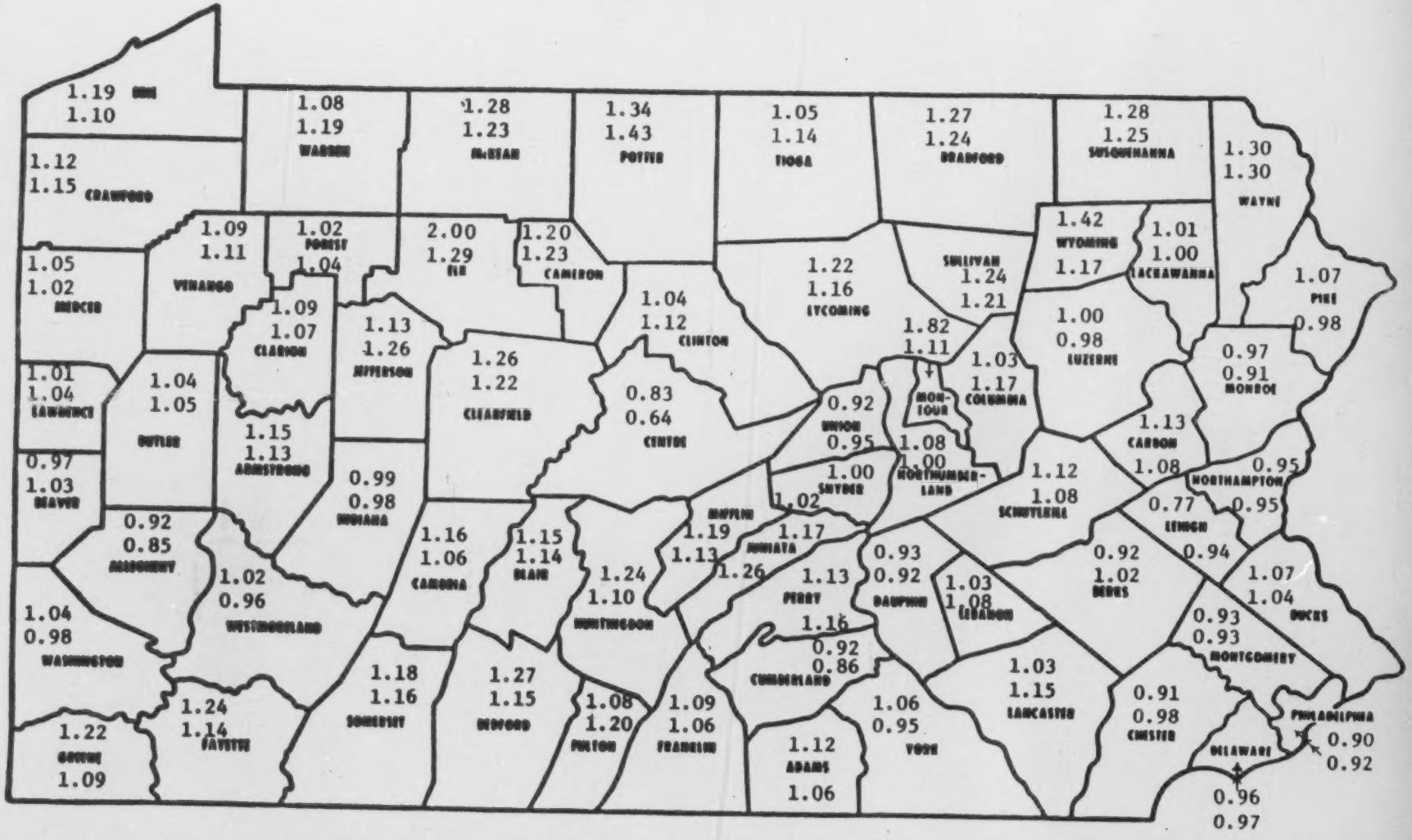
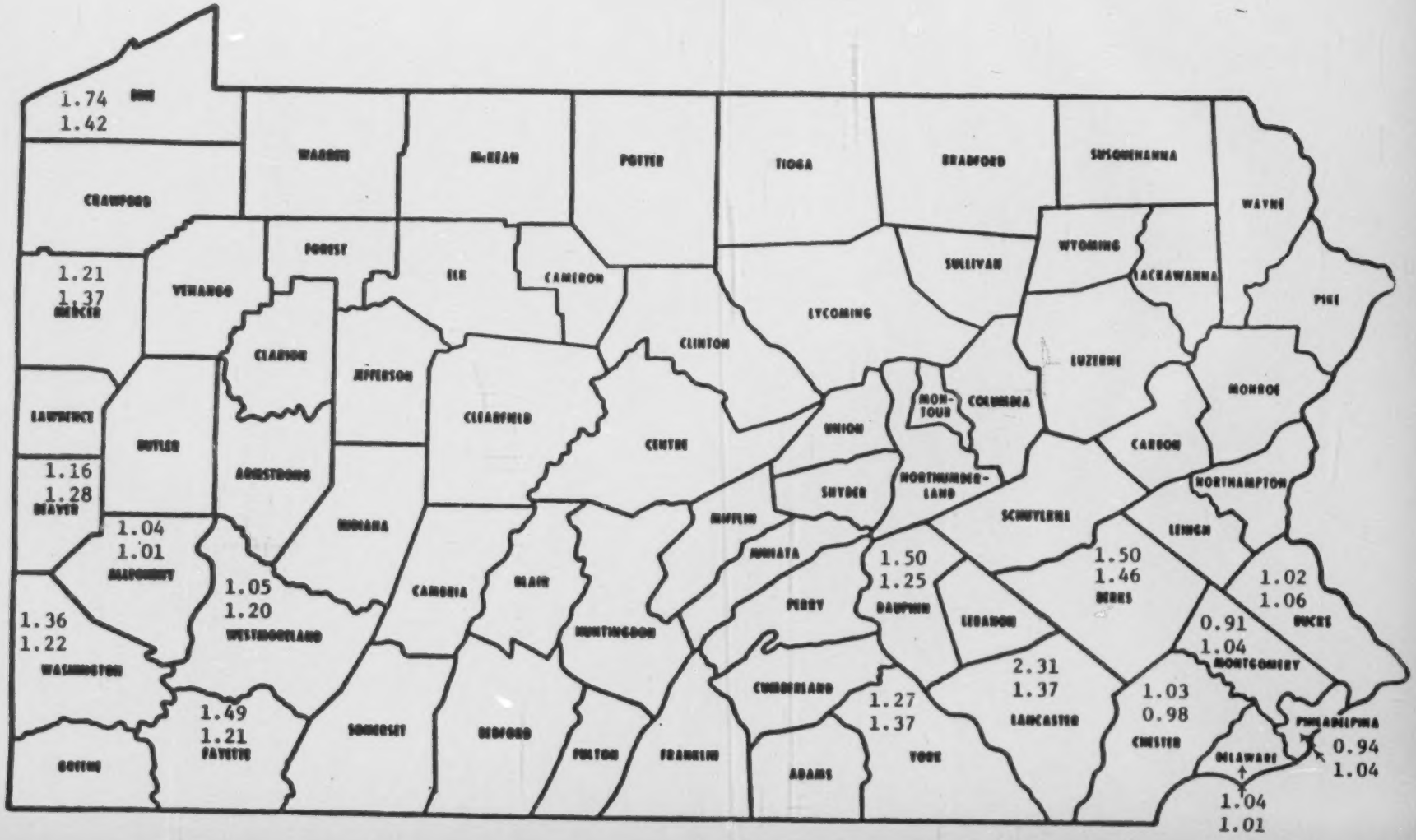


CHART 2: RATIO OF COUNTY TO STATE MODIFIED GENERAL FERTILITY RATES: 1970, 1980. (NON-WHITES)

1970 - Top
1980 - Bottom

COUNTIES OF PENNSYLVANIA



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MORTALITY EXPERIENCE IN PENNSYLVANIA: 1960-2000

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Mortality Experience in Pennsylvania: 1960-2000

Summary

This paper provides a comparative analysis of mortality in Pennsylvania and the U.S. for the 1960-80 period for white and nonwhite males and females. In addition, projected five-year survival rates for Pennsylvania are presented for the 1980-2000 period. Among the main findings are:

* Life expectancy in the U.S. and Pennsylvania has increased considerably over the 1960-80 period. Longevity for each sex-race group in Pennsylvania, however, is lower than the comparable figure for the U.S., despite some evidence of recent convergence.

* There are significant race and sex differentials in life expectancy. White females showed the highest life expectancy (77.9 years) in Pennsylvania in 1980, and nonwhite males the lowest (64.1 years).

* Survival rates for Pennsylvania reveal that the probability of surviving over a five year period peaks at ages 5-9 for each sex-race group, and then declines systematically thereafter. Race differentials in mortality persist at each age until about age 75 or so, but then nonwhites have higher survivorship than whites.

* Pennsylvania five-year survival rates parallel those of the United States. There is some evidence, however, of higher survivorship at younger ages in Pennsylvania than the U.S., but at older ages survivorship slightly favors the U.S. Among whites, there is also some recent convergence between Pennsylvania and the U.S. in survivorship at older ages.

* Projected survival rates to the year 2000 reveal a clear pattern of improvement for all sex-race groups in Pennsylvania, with expected gains in survivorship most apparent at older ages.

Mortality Experience in Pennsylvania: 1960-2000

During this century, there have been substantial increases in longevity in the United States. At the turn of the century, individuals could expect to live only to age 49, on the average. By 1980, life expectancy in the U.S. was nearly 74 years (National Center for Health Statistics, 1981). Patterns of longevity in Pennsylvania, however, have differed historically with patterns for the U.S. as a whole. In this report, we provide a comparative profile of these recent patterns of mortality in Pennsylvania and the United States, and project changes in Pennsylvania mortality to the year 2000.

An initial objective is to determine whether mortality patterns in Pennsylvania and the United States are converging, diverging, or remaining relatively constant over the 20 year period between 1960 and 1980. This is achieved as follows. First, we compare life expectancies in 1960, 1970, and 1980 for Pennsylvania with similar figures for the United States. This is completed separately by race (i.e., white-nonwhite) and sex. Second, for each of these years, we calculate survival rates for five-year age groups for Pennsylvania and the United States. These rates enable us to ascertain differences in mortality by age for Pennsylvania and the United States. They also allow inferences to be made about historic differences between the United States and Pennsylvania in age patterns of mortality. Based on this analysis, a final objective will be to project five-year survival rates for Pennsylvania to the year 2000. This will be accomplished by trending Pennsylvania rates to the projected national five-year survival rates prepared by the Social Security Administration (See U.S. Bureau of the Census, 1984).

Procedures

The following comparative analysis of Pennsylvania and U.S. mortality for each sex-race group is based on the 1959-61 and 1969-71 U.S. and Pennsylvania decennial life tables (U.S. Department of Health, Education, and Welfare, 1966, 1968, 1975a, 1975b). For 1980, we use the U.S. abridged life tables prepared by the National Center for Health Statistics (National Center for Health Statistics, 1981). For Pennsylvania, 1980-based life tables were calculated for each sex-race group using the average yearly number of deaths for the 1979-81 period (Shoen, 1978). These life tables are provided in Appendix A. County-specific life tables were not constructed because: (1) annual deaths by age at the county level exhibit considerable temporal instability; and (2) inter-county variability in longevity for each sex-race group is minimal.

The life table is a useful device for the analysis of comparative longevity. This method translates current age-specific death rates into probabilities of dying during a given one or five-year period. These probabilities provide the basis for calculating a number of life table based measures of mortality. In this report, we will present two of them. Life expectancy is the average number of years that an individual is expected to live, if exposed to current age-specific probabilities of dying. We will compare life expectancy at birth for the four sex-race groups in both the U.S. and Pennsylvania for 1960, 1970, and 1980. This will enable us to evaluate whether life expectancy in Pennsylvania has converged with national life expectancy. A second comparative approach will be to present five-year survival rates by sex, race, and five-year age group. A survival rate reveals the proportion of individuals in a five-year age group that is expected to live five more years given current age-specific probabilities

of dying. Not only do we anticipate substantial differences by age, sex, and race, but we also expect that survivorship will vary between the U.S. and Pennsylvania over the 1960-1980 period.

Pennsylvania and U.S. Mortality Patterns: 1960-1980

Life expectancy. In Figures 1 and 2, we chart recent changes in life expectancy for the white and nonwhite male and female populations of Pennsylvania and the U.S. These data reveal substantial increases in life expectancy in the U.S. and Pennsylvania since 1960. For example, U.S. life expectancy in 1980 was 70.70 and 78.10 years for white males and females, respectively. This represents a significant increase over the 1960 life expectancies (See Figure 1). During this twenty-year period, life expectancy increased by 2.76 years for white males and by 2.61 years for white females.

Although life expectancy of U.S. nonwhites is considerably below that of whites, nonwhites have also experienced gains in life expectancy. In 1960, life expectancy was 61.48 years for U.S. nonwhite males and 66.47 years for nonwhite females. By 1980, male and female longevity increased to 65.30 and 73.60 years, respectively. Indeed, the years gained in life expectancy for nonwhites exceeded those for whites, suggesting some convergence since 1960 in longevity between whites and nonwhites. In 1960, the difference in life expectancy between white and nonwhite males in the U.S. was 6.07 years. By 1980, this race difference had declined to 5.4 years. The female race difference during this period declined from 7.72 in 1960 to 4.50 in 1980.

As evident in Table 1, longevity in Pennsylvania during this 20 year period compared somewhat unfavorably with national longevity for each

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race-sex group. That is, life expectancy was generally lower during each period considered. Only in 1960, among nonwhite males and females, did Pennsylvania have higher life expectancy than the corresponding U.S. figure. Yet, in general, the gains in life expectancy since 1960 in Pennsylvania have exceeded those for the U.S. As a result, Pennsylvania life expectancy appears to be converging with national figures. For example, among white males, the difference in life expectancy between the U.S. and Pennsylvania declined from .50 years in 1960 to .07 years in 1980. A similar pattern of convergence occurred for white females. In 1960, the expectation of life for white females was over one year less in Pennsylvania than for the U.S. as a whole. By 1980, this difference declined to about one-quarter of a year of life.

The pattern of convergence is somewhat more erratic for nonwhites. There nevertheless is a clear pattern of convergence since 1970. In 1970, the difference in life expectancy between the U.S. and Pennsylvania was 1.56 years for nonwhite males and .80 years for nonwhite females. By 1980, these differences had declined to 1.23 and .31 years for nonwhite males and females, respectively. Thus, there is considerable evidence of convergence in U.S.-Pennsylvania overall mortality, although perhaps less so among nonwhites.

Although these results reveal a pattern of convergence in life expectancies, they do not necessarily imply that mortality at all ages is higher in Pennsylvania than the nation as a whole. Nor do the results above provide conclusive evidence that convergence in mortality exists at every age. To evaluate age patterns of mortality, we provide in the next section five-year survival rates for the U.S. and Pennsylvania.

Five-year survival rates. In Tables 2 and 3, we provide five-year life table survival rates for white males, white females, nonwhite males, and nonwhite females in Pennsylvania. These survival rates reflect current age-specific mortality rates, and reveal the proportion of individuals aged x to x+5 who are expected to live five more years.

The Pennsylvania survivorship rates reveal the expected age pattern of mortality for each race-sex group (See Figure 3). Regardless of period considered, survivorship peaked for those initially aged 5-9. In 1980, for example, the survival rate for 5-9 year old white males in Pennsylvania was .99882, and was .99911 for similarly aged white females. This means that, given current age specific mortality rates, both males and females aged 5-9 in 1980 have over a 99 percent chance of living 5 more years (i.e., to age 10-14). For blacks, the survivorship rates for this age group was somewhat lower---.99844 for males and .99862 for females. These survivorship rates, like life expectancy, reveal significant race and sex differentials in mortality.

As expected, five-year survivorship rates, after peaking at ages 5-9, decline systematically thereafter with age. The five-year survival rates remain quite high (e.g., over 80 percent) until age 65 or so, and then decline rather rapidly (Figure 3). For example, in Pennsylvania among white males aged 60-64 in 1980, about 87 percent are expected to live to age 65-69. However, only 62 percent of those initially aged 75-79 are expected to survive to ages 80-84, and only 42 percent of those aged 80 and over are likely to live five more years. A similar decline, albeit a slower one, is evident for white females. About 93 percent of those aged 60-64 are expected to live to age 65-69. Females aged 75-79, and 80 and over, have a 75 and 51 percent chance, respectively, of surviving five more

years. Not only is the expectation of life at birth higher for females than males, but these five-year survival rates favor females over males at every age. This sex differential in mortality at each age is also apparent for the nonwhite population in Pennsylvania.

The data in Tables 2 also reveal considerable change over time in survival rates. For Pennsylvania white males and females, survivorship increased at every age between 1960 and 1980. Thus, the gains in life expectancy reported earlier reflect reductions in age-specific mortality at every age. The gains in life expectancy are not due, for example, to improvements in mortality for only one age-segment (e.g., elderly) of the population. It is apparent, however, that the increases in survivorship are greatest at the advanced ages, where the most room for improvement exists. For example, among Pennsylvania white males, initially aged 70-74, the survival rate increased from .68 in 1960 to .72 in 1980. Likewise, the survival rate increased from .56 in 1960 to .62 in 1980 for those aged 75-79, and from .36 to .42 for those aged 80 and above. For white females, the greatest absolute increases in survivorship were also observed for the three oldest age groups.

Temporal changes in nonwhite survivorship are less systematic (see Table 3). In Pennsylvania, nonwhite male survivorship declined between 1960 and 1970 for those aged 10-79. Obviously, the declines in black male life expectancy between 1960 and 1970 reflect increases in mortality at most ages. For black females, changes between 1960 and 1970 were more erratic, with gains at some ages and declines in survivorship at others. Unlike the 1960-70 period, however, the patterns for 1970-80 are clear. That is, survivorship increased at every age for non-white males and

females. And, like whites, the largest increases in survivorship were for the oldest age groups.

Thus far we have described the age pattern of survivorship and temporal shifts in survivorship for each sex-race group. But how does Pennsylvania survivorship compare with the United States, and is there evidence of temporal convergence in rates at each age, as was apparent in the examination of life expectancies? To examine this issue, we report the ratio of Pennsylvania survivorship to U.S. survivorship for each five-year age group (see Tables 4 and 5). Values greater than 1.0 indicate higher survivorship for Pennsylvania, while ratios less than 1.0 reveal superior survivorship for the U.S. as a whole. Ratios that approach 1.0 over time suggest a pattern of convergence in mortality between Pennsylvania and the U.S.

The ratios for whites reported in Table 4 reveal several patterns. First, for white males and females, it is apparent that survivorship at younger ages (say, before age 45 in 1980) is generally higher in Pennsylvania than the U.S. Although the temporal pattern fluctuates overtime, a clear pattern of superiority in survivorship exists at younger ages (except 0-4 for white males in 1970 and 1980, and 0-4 females in 1980).

At older ages for white males and females, the pattern is reversed. For each period considered, survivorship is higher in the U.S. than in Pennsylvania. This suggests that age-specific mortality rates are higher in Pennsylvania than in the U.S. at older ages (say, beyond 45). The silver lining to the higher mortality in Pennsylvania is that there is a clear pattern of convergence over time in U.S./Pennsylvania mortality after age 45 or so. That is, the ratio for these five-year age groups has

increased during each period considered. As an illustration, in 1960 the ratio of survivorship rates for white males initially aged 75-79 was .95398. By 1970, this ratio had increased to .96331, and increased further to .98357 by 1980. A similiar pattern of convergence exists for older white females. To summarize, these data for whites reveal a pattern of higher and persistent survivorship in Pennsylvania at younger ages, and lower but converging survivorship at older ages.

This general pattern, however, applies to the white population, but is not clearly apparent for nonwhites. Among nonwhites in 1980, the survival rates for males and females favor the U.S. at ages between age 20 and age 75 or so (Table 5). Moreover, the temporal patterns diverge with U.S. patterns at some ages (particularly during childhood and among young adults), and converge at older ages (especially after age 50 or so). Although the nonwhite pattern is highly erratic, it is worth pointing out that the ratios in 1980 vary between a low of .99440 and a high of 1.07853. Consequently, even though a systematic relationship between U.S. and Pennsylvania survivorship is less apparent for nonwhites than whites, one should not lose sight of the fact that mortality at most ages is quite similar between the nonwhite populations of Pennsylvania and the U.S.

Pennsylvania Projected Survival Rates: 1980-2000

In this section, we provide projected five-year survival rates for each of the four sex-race groups for 1980-85, 1985-90, 1990-95, and 1995-2000. Based on the historic relationship between mortality in Pennsylvania and the U.S. described in the previous section, we have trended Pennsylvania five-year survivorship to the U.S. survival rates (middle series) that have been projected to the year 2000 by the Social

Security Administration (for details, see U.S. Bureau of the Census, 1984). The projected Pennsylvania survival rates not only provide some indication of the course of future mortality in Pennsylvania, but are also useful for the purpose of preparing population projections. Using a cohort component projection model, current population by age-sex-race can be "survived forward" to project the expected future size of population in Pennsylvania (in the absence of fertility and migration).

The trending algorithm we use is based on the following assumptions. For older white males and females in Pennsylvania, we observed in the previous section a clear pattern of convergence with U.S. survivorship. To project Pennsylvania survival rates to the year 2000 for these converging age-sex groups, we assumed that the rate of convergence over 1960-80 would continue for the 1980-2000 period. For example, if the difference between the Pennsylvania and U.S. survival rates at age x to x+5 declined by $\underline{y}$ percent between 1960 and 1980, we assumed that the difference between our projected Pennsylvania survival rate and the projected U.S. survival rate would be reduced an additional $\underline{y}$ percent by 2000. The projected Pennsylvania survival rates during the intervening periods were then calculated by linear interpolation.

At younger ages for whites and for nonwhites in general, no clear pattern of convergence emerged during the 1960-80 period. Thus, to obtain projected Pennsylvania survival rates for these age-sex-race groups in 2000, the ratios of Pennsylvania-to-U.S. survival rates in 1980 were maintained to the year 2000. For example, suppose that the ratio of Pennsylvania-to-U.S. survivorship for black males, aged x to x+5, was $\underline{y}$ in 1980. This ratio, $\underline{y}$, was then multiplied by the projected U.S. survival rate in 2000 to obtain the projected Pennsylvania survival rate. Thus,

where convergence between U.S. and Pennsylvania survivorship was not indicated between 1960 and 1980, we assumed that the 1980 relationship between Pennsylvania and U.S. survivorship would continue to the year 2000. Pennsylvania survival rates during the intervening years were again obtained by linear interpolation.

Given this methodology, the projected Pennsylvania survival rates to the year 2000 are provided in Tables 6 and 7 for each age-sex-race group. These data reveal projected increases in five-year survival rates for each five-year period between 1980 and 2000. As in the analysis of 1960-80 survival rates, these projected survival rates reveal that the most significant increases in survivorship are expected at the oldest ages for all four sex-race groups. This can be readily observed in Figures 4-7, where survival rates by five-year age-race-sex-groups are provided for 1980 and for the projected period 1995-2000. For example, the five-year survival rate for white males initially aged 80 is .427020 for 1980-85, and increases to .467878 by 1995-2000 (See Table 6). These data also indicate that females (both white and nonwhite) will continue to the year 2000 to have higher survival rates at each age than do males. Moreover, the race differential in survivorship will be maintained at younger ages through the year 2000. However, as in the period between 1960 and 1980, survival rates are higher for nonwhites than whites after age 60.

Summary

The purpose of this report has been to document comparative patterns of mortality in Pennsylvania and the U.S. for the 1960-80 period. In addition, projected survival rates have been provided for the 1980-2000 period. As we have documented, the mortality experiences of residents in

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Pennsylvania have differed historically from those found for the U.S. as a whole. Life expectancies are somewhat lower in Pennsylvania than the U.S., and five-year survival rates remain lower at older ages than those found for U.S. as a whole. However, survivorship is generally higher in the younger ages for whites and there is a clear pattern of convergence between Pennsylvania and the U.S. in longevity. Moreover, for all age-sex-groups considered here, continuing reductions in mortality are expected over the 1980 to 2000 period.

References

National Center for Health Statistics
1981 Vital Statistics of the United States, 1980, Life Tables. Volume II, Section 6. Hyattsville, Maryland: U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics.

Shoen, Robert
1978 "Calculating Life Tables by Estimating Chiang's a From Observed Rates." Demography 15(November): 625-635.

U.S. Bureau of the Census
1984 Projection of the Population of the United States, by Age, Sex, and Race: 1983 to 2080. Current Population Reports, Series P-25, No. 952. Washington, D.C.: U.S. Government Printing Office.

U.S. Department of Health, Education, and Welfare
1966 Pennsylvania State Life Tables: 1959-61. Volume 2, No. 39. Washington, D.C.: U.S. Department of Health, Education, and Welfare, Public Health Service.

1968 United States Life Tables: 1959-61. Volume 1, Nos. 1-6. Washington, D.C.: U.S. Department of Health, Education, and Welfare, Public Health Service.

1975a National Life Tables: 1969-71. Volume 1, Nos. 1-5. Rockville, Maryland: U.S. Department of Health, Education and Welfare, Pubic Health Service.

1975b Pennsylvania State Life Tables: 1969-71. Volume II, No. 39. Rockville, Maryland: U.S. Department of Health, Education, and Welfare, Public Health Service.

Table 1. Expectation of Life at Birth, 1960-1980

	United States			Pennsylvania		
	1960	1970	1980	1960	1970	1980
White						
Male	67.55	67.94	70.70	67.04	67.71	70.63
Female	74.19	75.49	78.10	73.13	74.69	77.87
Nonwhite						
Male	61.48	60.98	65.30	61.67	59.42	64.07
Female	66.47	69.05	73.60	66.49	68.25	73.29

Table 2. Five-Year Survival Rates for Pennsylvaia White Males and Females, 1960-1980

Initial Age	Terminal Age	Males			Females		
		1960	1970	1980	1960	1970	1980
Birth	0-4	.97408	.97932	.98662	.97989	.98356	.98929
0-4	5-9	.94597	.99668	.99804	.99705	.99738	.99835
5-9	10-14	.99783	.99809	.99882	.99857	.99864	.99911
10-14	15-19	.99628	.99605	.99625	.99834	.99830	.99853
15-19	20-24	.99338	.99201	.99276	.99753	.99743	.99781
20-24	25-29	.99301	.99173	.99222	.99699	.99699	.99756
25-29	30-34	.99335	.99277	.99276	.99599	.99620	.99717
30-34	35-39	.99049	.99041	.99186	.99388	.99438	.99601
35-39	40-44	.98395	.98474	.98791	.99039	.99120	.99342
40-44	45-49	.97215	.97395	.98018	.99468	.98550	.98889
45-49	50-54	.95177	.95678	.96633	.97572	.97683	.98222
50-54	55-59	.92426	.92880	.94581	.96204	.96423	.97190
55-59	60-64	.88626	.88825	.91340	.93823	.94536	.95620
60-64	65-69	.83235	.83610	.86605	.90059	.91502	.93077
65-69	70-74	.75499	.76784	.80034	.84650	.86550	.89165
70-74	75-79	.67751	.67698	.71619	.76553	.78756	.83327
75-79	80-84	.55561	.56691	.61915	.63830	.67648	.74638
80+	85+	.35784	.37980	.42021	.39453	.45145	.50733

Table 3. Five-Year Survival Rates for Pennsylvania Nonwhite Males and Females, 1960-1980

Initial Age	Terminal Age	Males			Females		
		1960	1970	1980	1960	1970	1980
Birth	0-4	.95248	.96136	.97397	.96020	.96853	.97775
0-4	5-9	.99310	.99439	.99673	.99517	.99532	.99723
5-9	10-14	.99679	.99751	.99844	.99761	.99841	.99862
10-14	15-19	.99521	.99242	.99628	.99769	.99720	.99861
15-19	20-24	.99179	.98136	.99017	.99555	.99476	.99724
20-24	25-29	.98843	.97473	.98404	.99261	.99272	.99454
25-29	30-34	.98515	.97251	.97992	.98844	.98986	.99279
30-34	35-39	.97839	.96423	.97521	.98439	.98389	.99018
35-39	40-44	.96751	.95275	.96674	.97709	.97409	.98425
40-44	45-49	.95187	.93802	.95138	.96427	.96381	.97428
45-49	50-54	.92223	.91299	.92996	.94351	.95004	.96112
50-54	55-59	.88518	.88232	.90428	.91468	.92830	.94885
55-59	60-64	.85040	.83859	.86488	.88297	.90023	.92570
60-64	65-69	.80120	.78840	.82285	.85159	.86620	.90175
65-69	70-74	.73560	.73526	.76577	.81493	.81410	.86105
70-74	75-79	.68572	.66775	.70015	.75770	.75760	.81126
75-79	80-84	.60869	.60146	.63011	.67313	.70615	.73534
80+	85+	.40007	.45580	.46836	.44521	.51715	.57448

Table 4. Ratio of Pennsylvania-to-U.S. Five-Year Survival Rates, Whites, 1960-1980

Initial Age	Terminal Age	Males			Females		
		1960	1970	1980	1960	1970	1980
Birth	0-4	1.00116	1.00035	.99981	1.00052	.99970	.99963
0-4	5-9	1.00026	1.00025	1.00065	1.00040	1.00012	1.00030
5-9	10-14	1.00022	1.00016	1.00034	1.00016	1.00004	1.00016
10-14	15-19	1.00057	1.00064	1.00059	1.00031	1.00044	1.00039
15-19	20-24	1.00091	1.00126	1.00143	1.00030	1.00059	1.00066
20-24	25-29	1.00097	1.00105	1.00144	1.00024	1.00040	1.00043
25-29	30-34	1.00115	1.00136	1.00104	1.00014	1.00036	1.00039
30-34	35-39	1.00073	1.00119	1.00101	.99986	1.00037	1.00043
35-39	40-44	1.00000	1.00116	1.00069	.99962	1.00055	1.00030
40-44	45-49	.99891	1.00050	1.00055	.99927	1.00025	1.00012
45-49	50-54	.99657	.99935	.99981	.98834	.99930	1.00025
50-54	55-59	.99353	.99664	.99973	.99522	.99767	.99991
55-59	60-64	.98998	.99183	.99657	.98921	.99423	.99889
60-64	65-69	.98326	.98754	.99129	.98081	.98917	.99508
65-69	70-74	.97414	.98011	.98316	.97269	.97791	.98911
70-74	75-79	.96462	.96977	.97567	.96670	.96977	.98458
75-79	80-84	.95398	.96331	.98357	.95723	.96248	.98904
80+	85+	.96638	.96942	.99449	.96855	.97638	.99754

Table 5. Ratio of Pennsylvania-to-U.S. Five-year Survival Rates, Nonwhites, 1960-1980

Initial Age	Terminal Age	Males			Females		
		1960	1970	1980	1960	1970	1980
Birth	0-4	1.00128	.99679	.99601	.99999	.99734	.99625
0-4	5-9	1.00085	1.00044	1.00071	1.00177	1.00031	1.00021
5-9	10-14	1.00014	1.00045	1.00039	.99992	1.00034	.99995
10-14	15-19	1.00097	.99941	1.00048	1.00073	1.00034	1.00050
15-19	20-24	1.00288	.99799	1.00051	1.00110	1.00056	1.00068
20-24	25-29	1.00393	.99759	.99946	1.00096	1.00078	.99972
25-29	30-34	1.00424	.99768	.99750	1.00079	1.00087	.99953
30-34	35-39	1.00346	.99598	.99704	1.00260	1.00037	.99944
35-39	40-44	1.00335	.99557	.99608	1.00398	.99840	.99869
40-44	45-49	1.00206	.99601	.99359	1.00179	.99847	.99680
45-49	50-54	.99695	.99121	.99254	.99841	.99840	.99462
50-54	55-59	.98969	.98879	.99382	.99552	.99405	.99727
55-59	60-64	.99289	.97869	.98660	.99516	.99024	.99440
60-64	65-69	.99366	.97779	.98467	.99339	.99078	.99806
65-69	70-74	.97764	.90005	.97593	.99563	.98514	.99686
70-74	75-79	.96415	.98148	.97473	.98235	.98327	1.00307
75-79	80-84	.94911	.96160	.99485	.95578	.98650	1.00116
80+	85+	.93148	.95289	1.07019	.96195	.96848	1.07853

Table 6. Projected Pennsylvania Survival Rates, Whites

Initial Age	Terminal Age	Males				Females			
		1980-85	1985-90	1990-95	1995-2000	1980-85	1985-90	1990-95	1995-2000
Birth	0-4	.986937	.987571	.988205	.988840	.989562	.990107	.990651	.991196
0-4	5-9	.998129	.998309	.998488	.998668	.998416	.998548	.998680	.998812
5-9	10-14	.998857	.998931	.999005	.999079	.999139	.999198	.999257	.999315
10-14	15-19	.996319	.996457	.996595	.996733	.998560	.998621	.998681	.998741
15-19	19-20	.992959	.993360	.993760	.994160	.997864	.997971	.998079	.998187
20-24	25-29	.992426	.992840	.993253	.993666	.997623	.997750	.997878	.998005
25-29	30-34	.992907	.993202	.993497	.993793	.997247	.997402	.997557	.997711
30-34	35-39	.992135	.992684	.993234	.993783	.996159	.996456	.996753	.997050
35-39	40-44	.988332	.989176	.990020	.990865	.993645	.994095	.994546	.994997
40-44	45-49	.980803	.982049	.983294	.984590	.989205	.989836	.990467	.991097
45-49	50-54	.967290	.969211	.971132	.973053	.982628	.983446	.984263	.985080
50-54	55-59	.947191	.949955	.952718	.955482	.972380	.973341	.974302	.975263
55-59	60-64	.915721	.920364	.925006	.929649	.957085	.958857	.960628	.962399
60-64	65-69	.869217	.875553	.881889	.888225	.932309	.935386	.938464	.941541
65-69	70-74	.804436	.812629	.820822	.829015	.894337	.899713	.905087	.910463
70-74	75-79	.721746	.732861	.743974	.755088	.837933	.847260	.856586	.865913
75-79	80-84	.626195	.640286	.654377	.668468	.753756	.768508	.783261	.798014
80+	85+	.427020	.440639	.454259	.467878	.515279	.531177	.547075	.562973

Figure 1

UNITED STATES LIFE EXPECTANCY

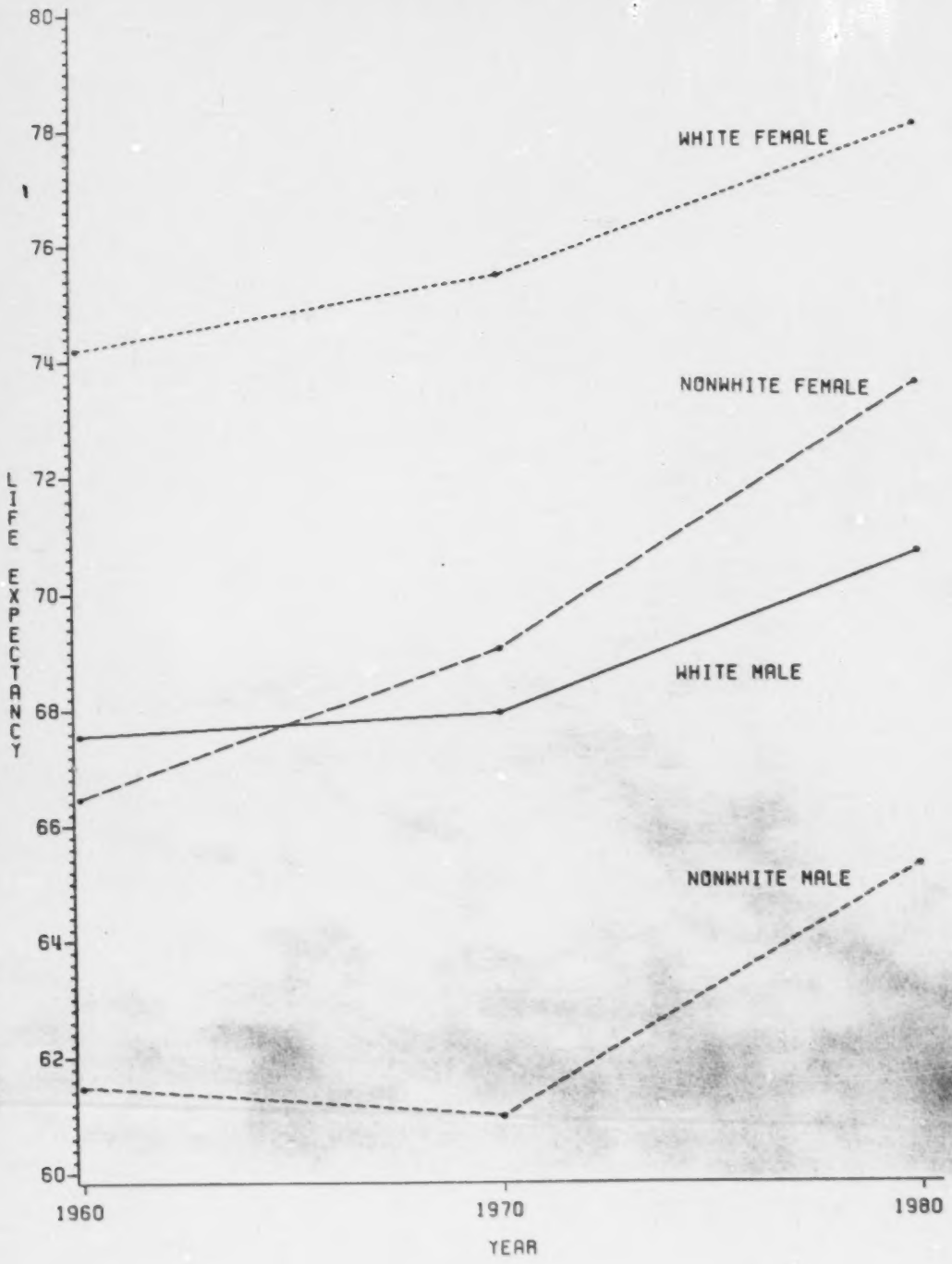


Figure 2

PENNSYLVANIA LIFE EXPECTANCY

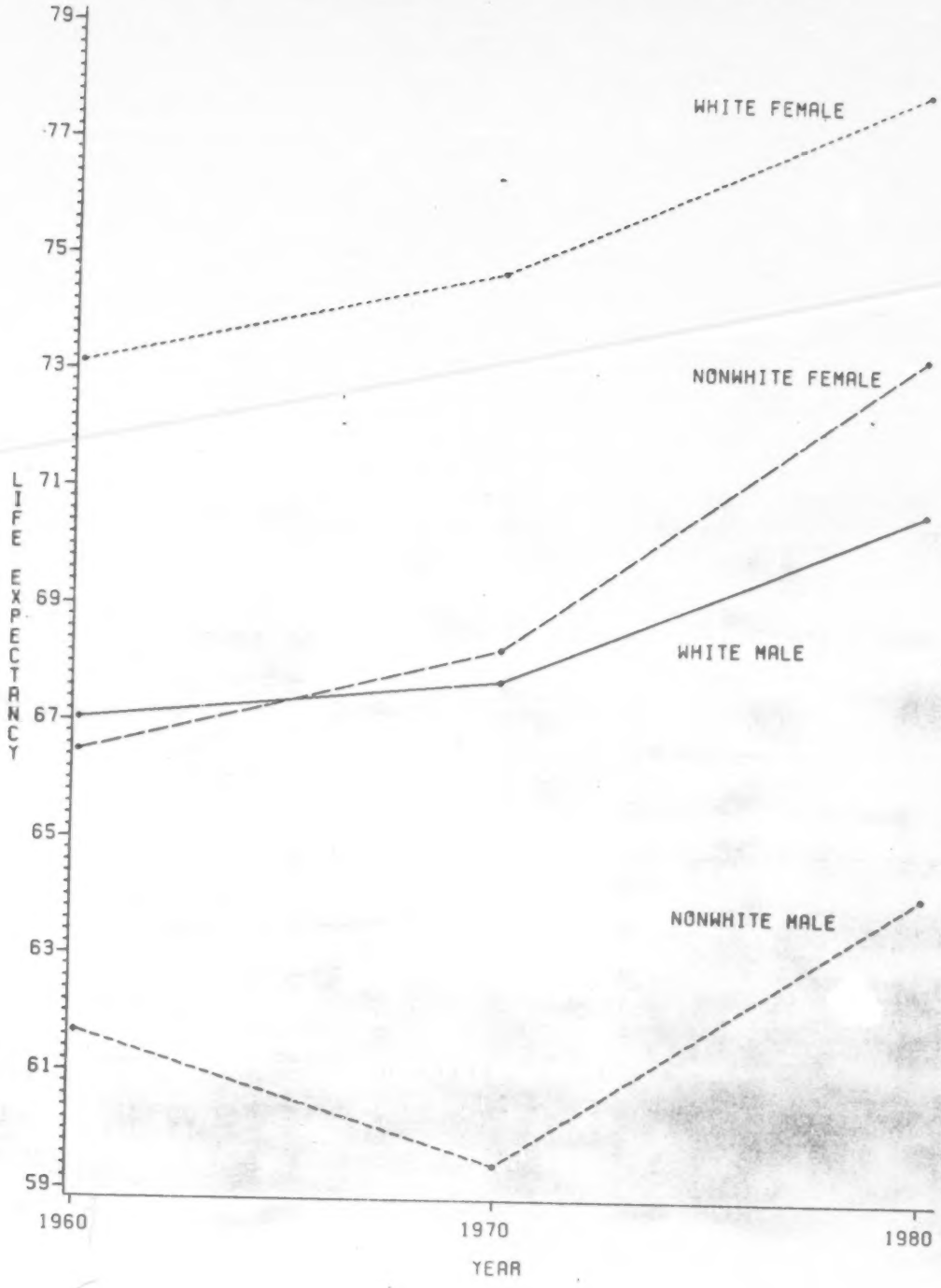


Figure 3

1980 PENNSYLVANIA 5-YEAR SURVIVAL RATES

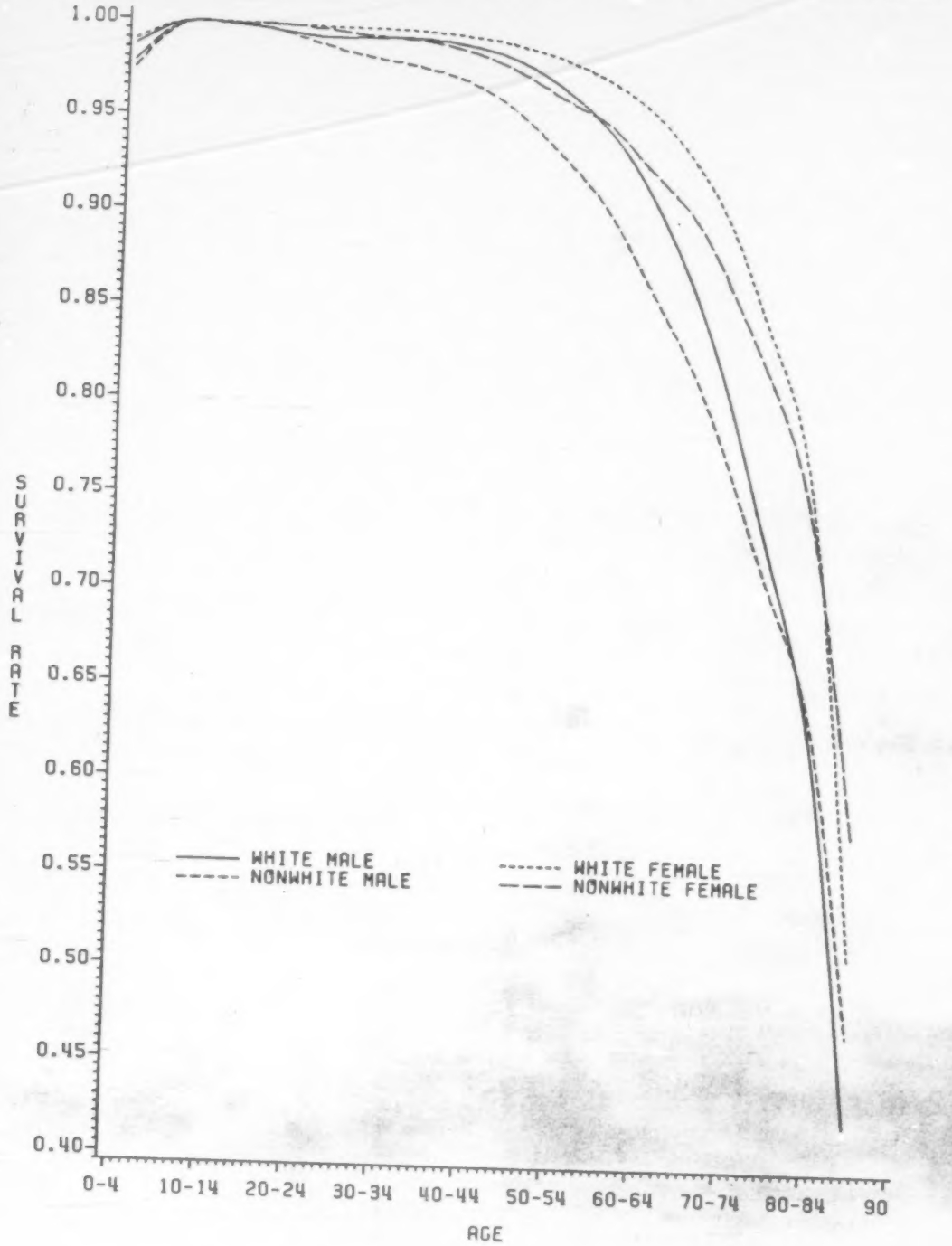


Figure 4

WHITE MALE 5-YEAR SURVIVAL RATES

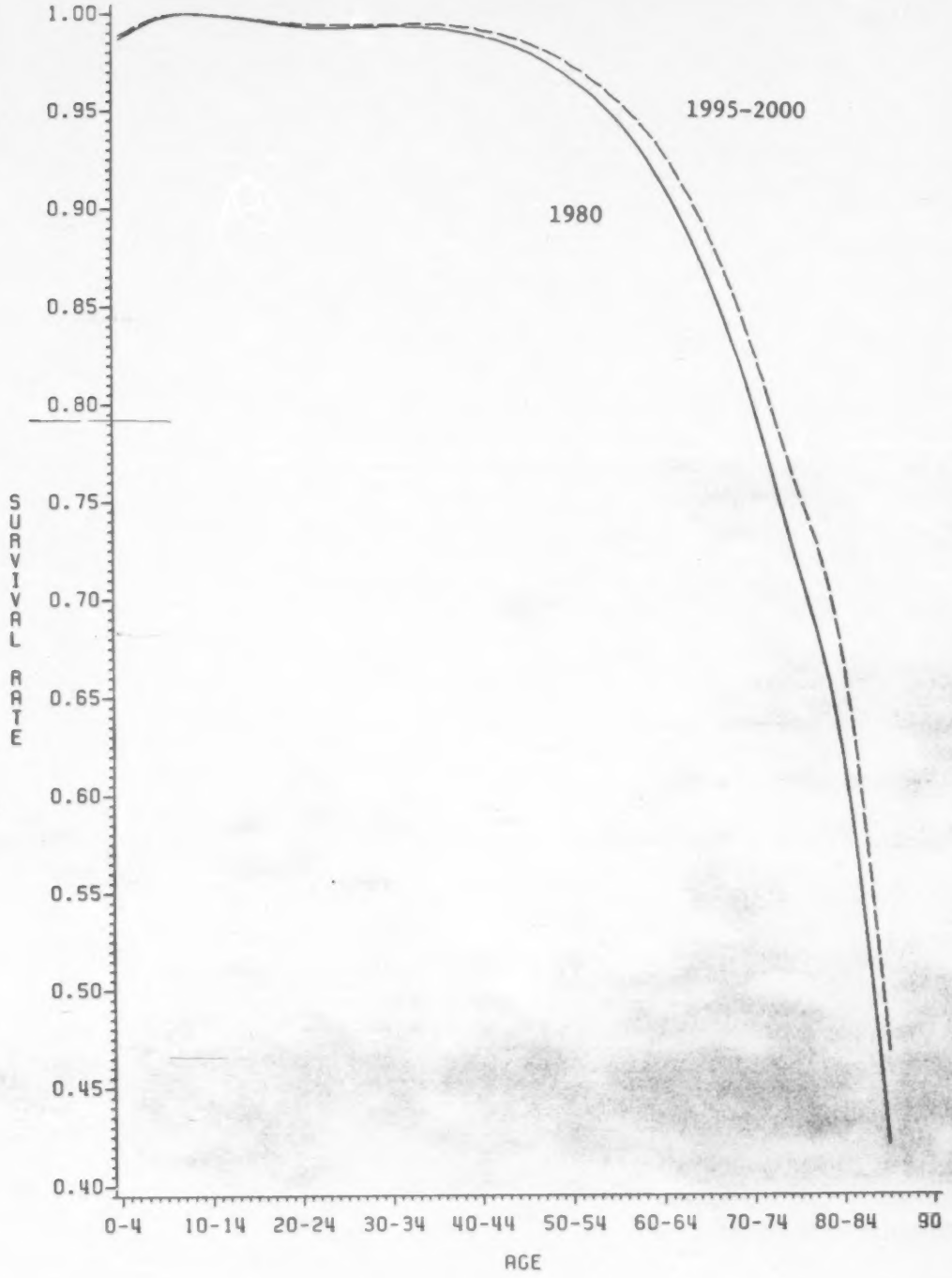


Figure 5

WHITE FEMALE 5-YEAR SURVIVAL RATES

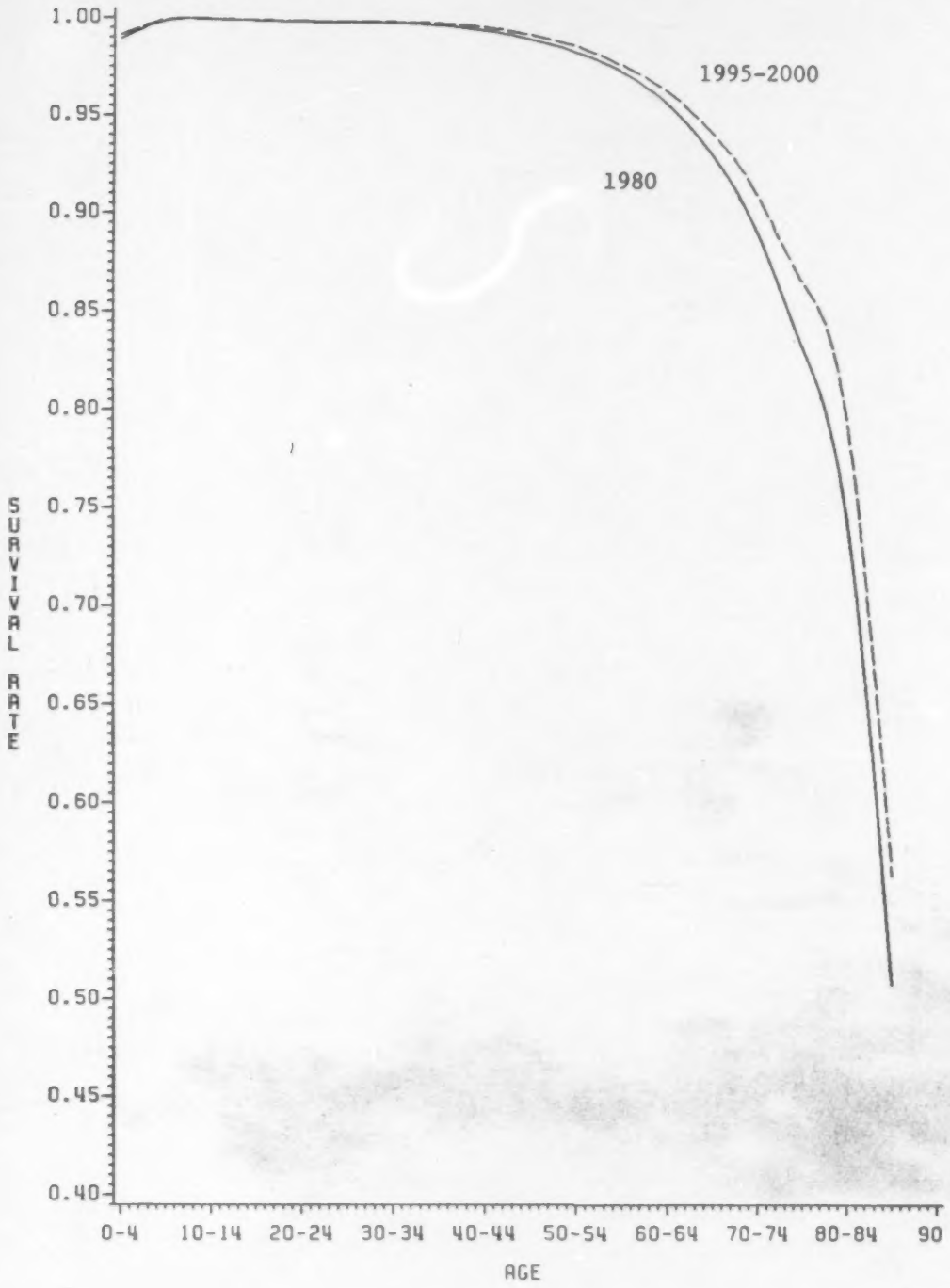


Figure 6

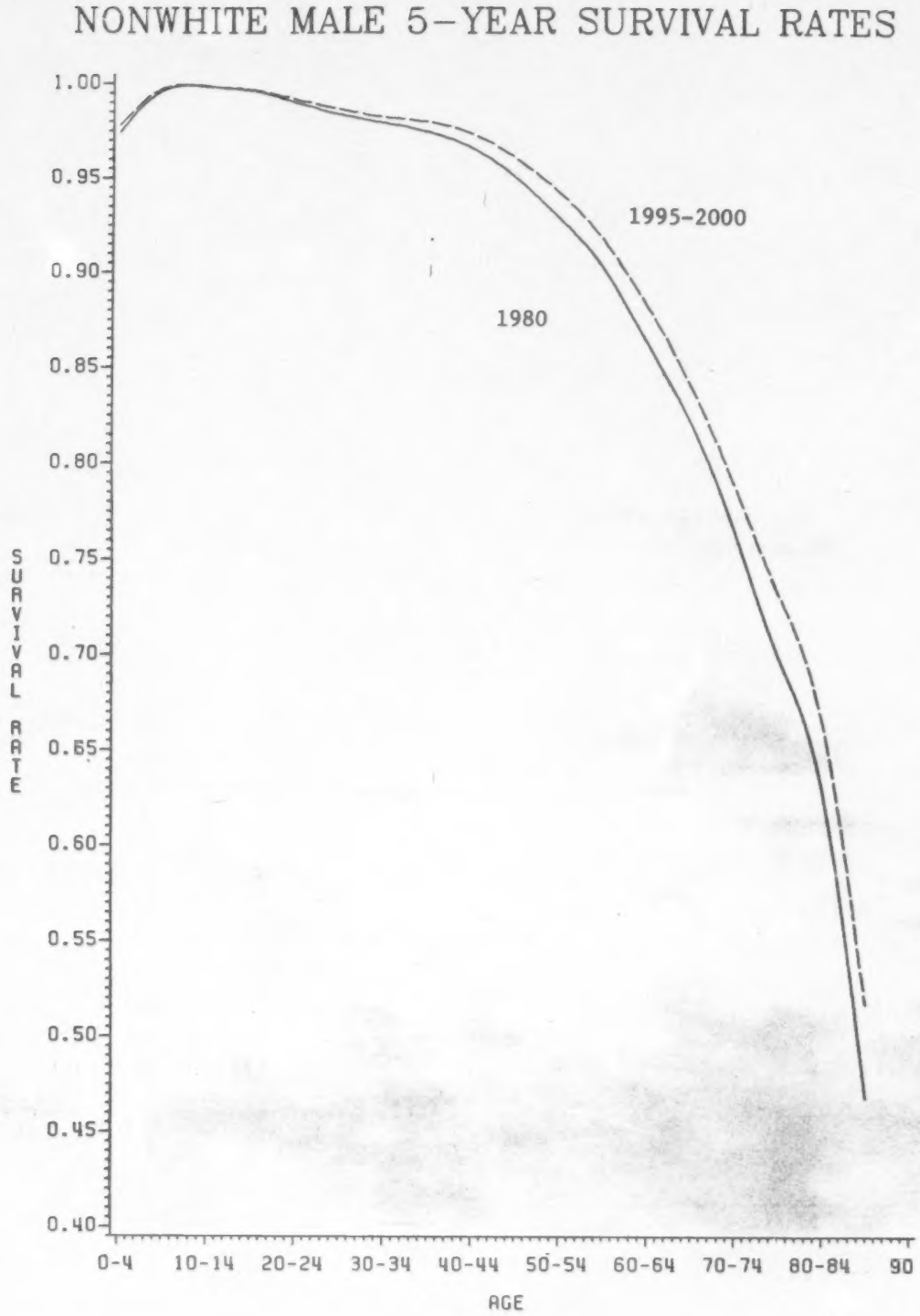
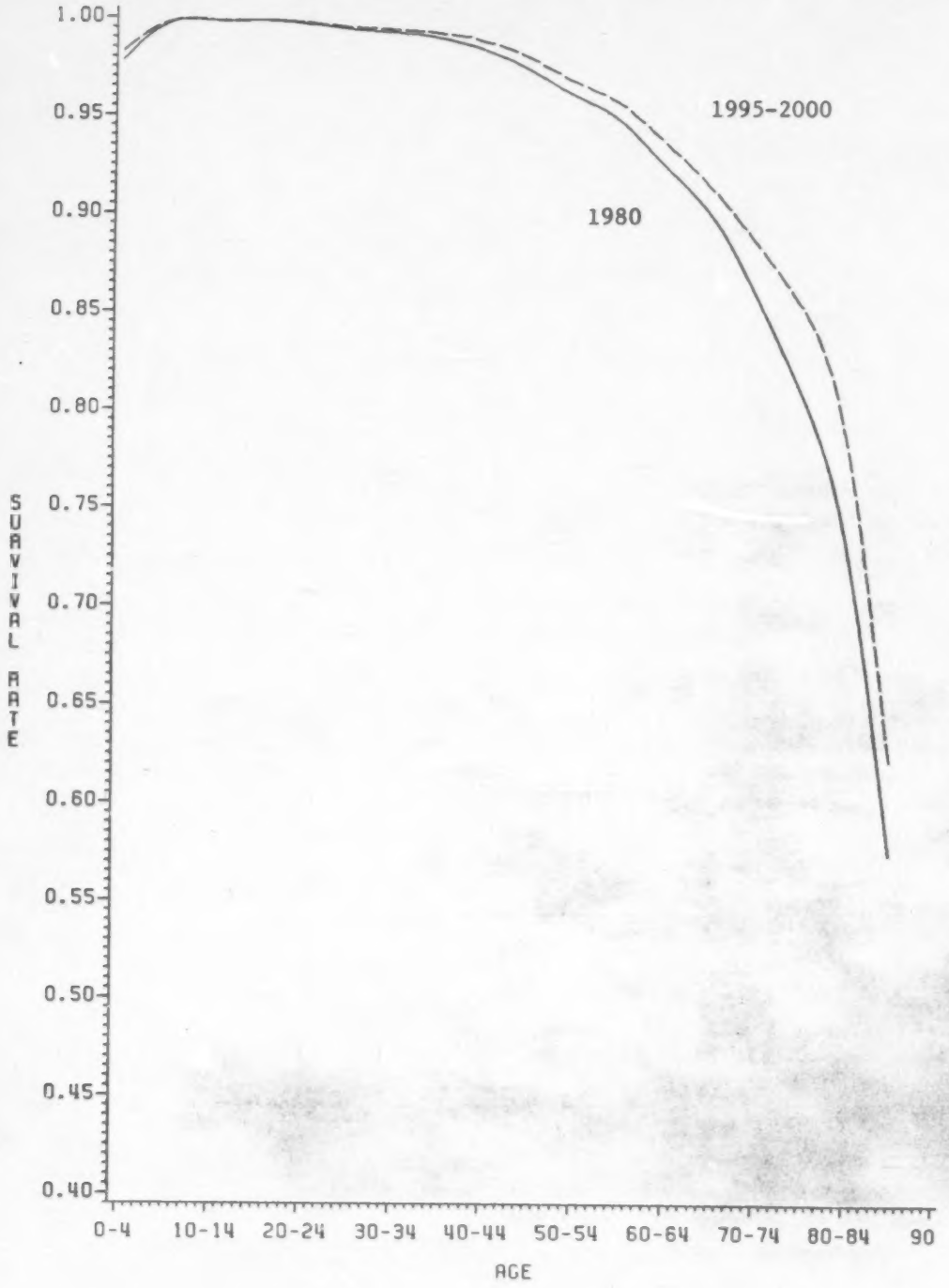

NONWHITE MALE 5-YEAR SURVIVAL RATES
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
SURVIVAL RATE
1995-2000
1980
0-4
10-14
20-24
30-34
40-44
50-54
60-64
70-74
80-84
90
AGE

Figure 7

NONWHITE FEMALE 5-YEAR SURVIVAL RATES



Appendix A

1980 Abridged Life Tables for Pennsylvania

Table A-1. Abridged Pennsylvania Life Tables: White Males, 1980

x to x + n	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0-1	.012531	100000	1253	98862	7062805	70.628
1-5	.002181	98747	215	394449	6963943	70.523
5-10	.001264	98532	125	492342	6569495	66.674
10-15	.001637	98407	161	491763	6077153	61.755
15-20	.005792	98246	569	489921	5585390	56.851
20-25	.008209	97677	802	486374	5095469	52.167
25-30	.007325	96875	710	482592	4609096	47.578
30-35	.007425	96165	714	479100	4126504	42.910
35-40	.009435	95451	901	475199	3647405	38.212
40-45	.015411	94551	1457	469452	3172207	33.550
45-50	.025369	93094	2362	460147	2702755	29.033
50-55	.043124	90732	3913	444654	2242609	24.717
55-60	.067580	86819	5867	420557	1797955	20.709
60-65	.108208	80952	8760	384137	1377400	17.015
65-70	.163476	72192	11802	332680	993263	13.759
70-75	.240397	60391	14518	266257	660583	10.939
75-80	.334772	45873	15357	190691	394326	8.596
80-85	.458190	30516	13982	118066	203635	6.673
85+	1.000000	16534	16534	85569	85569	5.175

NOTE: x to x+n: Age interval between exact ages x and x+n

$_nq_x$: proportion dying between exact ages x and x+n

l_x: number of persons who survive to exact age x

$_nd_x$: number of persons dying between exact ages x and x+n

$_nL_x$: number of person years lived between exact ages x and x+n

T_x: number of person years lived between exact age x and all subsequent age intervals

e_x: average remaining lifetime at age x

Table A-2. Abridged Pennsylvania Life Tables: White Females, 1980

x to x + n	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0-1	.009982	100000	998	99089	7786906	77.869
1-5	.001824	99002	181	395556	7687817	77.653
5-10	.001057	98821	104	493828	7292262	73.792
10-15	.000921	98717	91	493387	6798436	68.868
15-20	.001979	98626	195	492663	6305048	63.929
20-25	.002349	98431	231	491586	5812386	59.051
25-30	.002583	98200	254	490385	5320800	54.184
30-35	.003228	97946	316	488999	4830415	49.317
35-40	.005012	97630	489	487048	4341416	44.468
40-45	.008487	97140	824	483843	3854368	39.678
45-50	.014116	96316	1360	478469	3370526	34.994
50-55	.022146	94956	2103	469964	2892057	30.457
55-60	.035059	92854	3255	456758	2422094	26.085
60-65	.054405	89598	4875	436754	1965336	21.935
65-70	.086545	84724	7332	406516	1528583	18.042
70-75	.134081	77391	10372	362469	1122068	14.499
75-80	.206592	67014	13845	302033	759599	11.335
80-85	.325918	53170	17329	225430	457567	8.606
85+	1.000000	35841	35841	232137	232137	6.477

NOTE: x to x+n: Age interval between exact ages x and x+n

$_nq_x$: proportion dying between exact ages x and x+n

l_x: number of persons who survive to exact age x

$_nd_x$: number of persons dying between exact ages x and x+n

$_nL_x$: number of person years lived between exact ages x and x+n

T_x: number of person years lived between exact age x and all subsequent age intervals

e_x: average remaining lifetime at age x

Table A-3. Abridged Pennsylvania Life Tables: Nonwhite Males, 1980

x to x + n	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0-1	.024918	100000	2482	97791	6406961	64.070
1-5	.003445	97508	336	389193	6309171	64.704
5-10	.001836	97172	178	485392	5919978	60.923
10-15	.001901	96994	184	489636	5434586	56.030
15-20	.006100	96809	591	482822	4949951	51.131
20-25	.013396	96219	1289	478084	4467120	46.427
25-30	.018304	94930	1738	470452	3989036	42.021
30-35	.022110	93192	2060	461004	3518584	37.756
35-40	.028220	91132	2572	449574	3057581	33.551
40-45	.039500	88560	3498	434623	2608007	29.449
45-50	.058672	85062	4991	413493	2173384	25.551
50-55	.082409	80071	6599	384531	1759892	21.979
55-60	.111714	73473	8208	347724	1375362	18.719
60-65	.159066	65265	10381	300741	1027640	15.746
65-70	.199716	54883	10961	247464	726899	13.244
70-75	.271429	43922	11922	189501	479435	10.916
75-80	.335343	32001	10731	132679	289934	9.060
80-85	.436177	21269	9277	83603	157255	7.393
85+	1.000000	11992	11992	73653	73653	6.142

NOTE: x to x+n: Age interval between exact ages x and x+n

$_nq_x$: proportion dying between exact ages x and x+n

l_x: number of persons who survive to exact age x

$_nd_x$: number of persons dying between exact ages x and x+n

$_nL_x$: number of person years lived between exact ages x and x+n

T_x: number of person years lived between exact age x and all subsequent age intervals

e_x: average remaining lifetime at age x

Table A-4. Abridged Pennsylvania Life Tables: Nonwhite Females, 1980

x to x + n	$_nq_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0-1	.021461	100000	2146	98084	7328560	73.286
1-5	.002563	97854	251	390789	7230476	73.890
5-10	.001881	97603	184	487519	6839688	70.077
10-15	.001107	97420	108	486844	6352169	65.204
15-20	.001886	97312	184	486166	5865326	60.274
20-25	.003825	97128	372	484823	5379160	55.382
25-30	.006885	96757	666	482176	4894338	50.584
30-35	.007880	96090	757	478698	4412163	45.917
35-40	.012298	95333	1172	473998	3933465	41.260
40-45	.019892	94161	1873	466532	3459468	36.740
45-50	.031967	92288	2950	454532	2992936	32.430
50-55	.045801	89338	4092	436858	2538404	28.414
55-60	.058733	85246	5007	414511	2101546	24.653
60-65	.089581	80239	7188	383712	1687035	21.025
65-70	.111089	73051	8115	346011	1303323	17.841
70-75	.167937	64936	10905	297933	957313	14.742
75-80	.218120	54031	11785	241701	659380	12.204
80-85	.335152	42246	14159	177732	417679	9.887
85+	1.000000	28087	28087	239947	239947	8.543

NOTE: x to x+n: Age interval between exact ages x and x+n

$_nq_x$: proportion dying between exact ages x and x+n

l_x: number of persons who survive to exact age x

$_nd_x$: number of persons dying between exact ages x and x+n

$_nL_x$: number of person years lived between exact ages x and x+n

T_x: number of person years lived between exact age x and all subsequent age intervals

e_x: average remaining lifetime at age x

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PENNSYLVANIA MIGRATION: 1965-2000

by

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Summary

This paper is an analysis of migration patterns in Pennsylvania and its sixty-seven counties for the period from 1965-85. From this analysis, projected migration rates are developed for the state and for each county for the 1985-2000 period. The major findings include:

* According to the 1980 Census, about 35,500 more people left Pennsylvania than moved to the state each year during the latter part of the 1970s. Net out-migration declined in the early 1980s. However, based on U.S. Bureau of the Census population estimates, there were still about 29,900 more people leaving Pennsylvania than moving to the state each year during the 1980-85 period.

* Based on these migration trends and on the changing determinants of inter-state migration, we project that the average annual net out-migration will decline to about -18,000 to -19,000 by the year 2000.

* Although the Commonwealth experienced substantial net out-migration during the early 1980s, 28 of the 67 counties had net in-migration during this period. The highest rates of net in-migration for the 1980-85 period were for Wayne, Pike, and Monroe Counties in the Pocono area, while the highest rates of net out-migration were for Cambria, Lycoming, and Beaver Counties. The largest number of net in-migrants were for Bucks, Chester, and Lancaster Counties, while the largest number of net out-migrants were for Philadelphia and Allegheny Counties.

* The age pattern of net migration for the state and most counties remained quite stable during the 1965-70 and 1975-80 periods.

* The approach used for developing future migration patterns for Pennsylvania counties is a county net migration typology. This typology is based on the concept of trended changes in past county-level net migration patterns and on changes in the theoretical determinants of net migration.

MIGRATION TRENDS IN PENNSYLVANIA: 1965-2000

The population of Pennsylvania has increased slowly since 1960 from 11,319,366 to 11,863,895 in 1980 (U.S. Bureau of the Census, 1982). This change in population size is an outcome of the twin demographic processes of natural increase (births minus deaths) and net migration (the difference between in- and out-migration). Although natural increase is an important source of population increase, the past pattern of substantial net out-migration from Pennsylvania has dampened considerably the rate of population growth. Migration patterns play a central role in determining why some states, cities, and counties grow more or less rapidly than others. Consequently, recent migration trends in Pennsylvania provide a key to understanding the dynamics of population change in Pennsylvania and its counties. In this report, we examine migration trends in the state and its 67 counties for the 1965-83 period, and then develop a typology to project the course of future migration to the year 2000.

Migration trends have been the topic of considerable interest among social scientists, planners, and members of the business community. This interest has been stimulated in part by the redistributions in U.S. population settlement that have taken place in recent decades. First is the continuing movement of population from the so-called "frost-belt" states, including Pennsylvania, to the "sun-belt." During the 1975-80 period, the Northeast and North Central regions exported 1.6 million more people to the South than they

imported (U.S. Bureau of the Census, 1981). A second significant redistribution pattern is the continuing suburbanization of population--the movement of population from cities to suburbs or from nonmetropolitan areas to suburban areas. Rapid suburbanization has greatly expanded the territorial scope of major metropolitan areas, although there is some recent evidence that the rate of suburbanization has slowed during the past decade (Frey, 1985). Third, during the 1970s, net in-migration favored nonmetropolitan areas at the expense of metropolitan areas. That is, in the 1970s, more people moved from metro to nonmetro areas than from nonmetro to metro areas (Tucker, 1976). This spreading out of population from more densely settled to less densely settled areas, however, appears to have slowed again in the earlier 1980s (Forstall and Engels, 1983). Thus, patterns of migration in the United States and Pennsylvania have changed substantially in the recent past and, as we shall illustrate in this report, have also affected the dynamics of population change in Pennsylvania.

The movement of population-including interstate and intercounty migration-has many causes. Economic factors surely play a role, although there is much recent evidence to suggest that economic considerations have played a declining role in recent migration trends (e.g., Heaton et al., 1981). In part, this reflects several recent demographic developments, including the aging of the population. The elderly, for example, are less likely to migrate in response to economic opportunities than are younger adults. In

addition, the suburbanization of population means that individuals can separate places of work from places of residence. The implication, of course, is that the growth of jobs in a county will not necessarily translate into an equal growth of new residents in that county. Noneconomic factors, on the other hand, appear to have played a growing role in recent migration trends. The importance of natural amenities (e.g., resort areas), for example, have clearly played a part in the rapid growth in the late 1970s in the Upper Great Lakes region, the Ozarks, the Upper New England states, and the Poconos in Pennsylvania. The implication of this fact is that considerations other than purely economic play a part in encouraging net in-migration to local areas.

In this report, three issues are considered. First, we examine net migration trends in Pennsylvania and its 67 counties for the 1965-70 and 1975-80 periods. Although we show that the Commonwealth has experienced substantial net out-migration during these periods, net out-migration is not a universal characteristic of all counties in Pennsylvania. Indeed, we show some significant changes in intercounty patterns of migration during this period. Second, we show that net migration for the state and each county varies significantly by age group. Some age groups have experienced significant out-migration during the recent past, while other age groups show more in-migration into certain counties. Third, and finally, we develop a typology to project the future course of migration for the state and its counties for each five

year period between 1980 and 2000. These projections are based not only on results from the 1965-70 and 1975-80 historic trends in Pennsylvania, but on the basis of recent analysis of 1980-85 net migration change using residential information furnished to the Census Bureau from the Internal Revenue Service, which are incorporated into updated 1985 estimates of county population. As we report, we expect some significant changes in the level of out-migration from Pennsylvania during the next 20 years, which will have implications for future migration patterns within the state.

MIGRATION DATA

In a cohort-component population projection model, a principal strategy is that projections are made specifically for sub-population groups. These cohorts can range from multi-year age groups to one year age/sex/race groups. In the Pennsylvania Population Projection and Estimates System Model, five year age/sex groups are used in counties with fewer than 5000 nonwhite and five year age/sex/race groups are used in the other counties and for the state.

Survival Method for Calculating Rates

In most projection models, migration rates for cohorts are determined from a survival rate methodology. A population is divided into cohorts at one point in time, generally a decennial census. To each of these cohorts a survival rate is applied to

determine the proportion of cohort expected to survive to another period, usually the decennial census ten years later. The difference between the population of each cohort that was expected to survive the period and the actual count of persons in the cohort ten years later is assumed to be the number of net migrants.

There are three shortcomings related to the survival rate technique of calculating net migration rates. First, the determination of the appropriate survival rates is often difficult. When the modelling strategy involves five year age cohorts, there should be two five year rates applied to a cohort over the ten year period. Since there are no good population counts for cohorts between censuses, the calculation of two distinct survival rates cannot be done with confidence. The use of a ten year survival rate means that some adjustment of migration rates is necessary to reflect the different migration rates of the cohort over the two five year periods between the censuses.

Second, there is a significant problem in using the survival rate methodology when there is an underenumeration in the censuses. That is, those persons who were missed in one census but counted in the following would be considered as in-migrants in this methodology. Currently this problem occurs most among nonwhite populations and is especially a problem in that there is an undercount for some ages (e.g., 15-19) and not for other ages. In this case it may appear that there is more in-migration to an area than really happened. At present, there exists no set of county level corrections that could be made to each cohort to estimate its underenumeration or overenumeration.

A third problem with this strategy is that migration rates are based on a ten year period. This long time period may contain events that are not relevant to the migration projections. For example, in the early 1970s there was a demobilization of members of the armed forces after the Viet Nam war build-up. This type of migration of males aged 20-29 years may not be appropriate in the 1980s and 1990s. Our analysis of the population changes in Pennsylvania counties from 1970-75 and 1975-80 showed that there was much more growth and therefore more in-migration in the earlier period. Rates based on the 1970-80 period may be less appropriate for monitoring migration than are rates from the 1975-80 period.

Census Five-year Residence Question

As an alternative methodology for computing migration rates for cohorts, we chose to use the question in the 1980 census which obtained data on where persons over age five had lived on April 1, 1975. This question was asked in the long form of the census which was completed by approximately 20 percent of all households. The location of the 1975 residence was coded for about half of those households completing the form, so approximately a 10 percent sample of all persons in the United States in 1980 comprise the data used for our calculation of migration rates.

The use of this retrospective question is not without drawbacks. First, the possibility exists that migrants may be differentially underenumerated. While this may occur, we see it as highly unlikely

to alter migration rates. Second, there may be errors in reporting of the residence five years earlier. There might be some people who cannot remember exact migration dates or who forget about having moved. Third, some error may occur because of the confusion of how to report a residence in a college or military setting on the April 1, 1975 reference data. Fourth, there is no direct means of determining the migration rate of the cohort under five years of age with this methodology.

The migration rates for those born from 1975 to 1980 were calculated in a manner similar to the survival rate methodology described above. The number of births in each county was obtained for each year for males and females and whites and nonwhites from 1975 and 1980. Since we were calculating migration rates for the five year period from April 1, 1975 to April 1, 1980, all births in 1976, 1977, 1978, and 1979 were added to 75 percent of the births in 1975 and 25 percent of the births in 1980. This total number of births was then multiplied by the respective sex/race survival rate that was derived from the Pennsylvania life table (Lichter et al., 1985) to produce a "survived" population of these cohorts. The difference between the "survived" population and the actual count in 1980 was taken to be the number of net migrants.

Again, this technique has some problems that must be considered. First, a uniform state survival rate for the sex/race groups was applied to each county. Data on infant mortality from vital statistics shows that the infant mortality rate differs by counties. As a test of

the sensitivity of using Pennsylvania rates for each county, we applied the respective age/race national survival rates to see if there was a noticeable difference in migration rates. We determined that there is no significant difference in migration rates. Second, because of the Census underenumeration of nonwhites in this age group, the comparison of the "survived" population and the actual counts showed that substantial out-migration occurred. Since the registration of births is relatively complete, this approach provides a reasonably accurate count of children 0-4. Therefore, the difference between the births and the underenumerated Census count makes it appear as though children had moved from the county.

The strategy undertaken to minimize this problem was to make a correction for the underenumeration of nonwhites under age five. The Census Bureau estimates that nationally about 9.6 percent of nonwhite males and 9.0 percent of nonwhite females in this age group were not enumerated in the 1980 Census. We, therefore, increased the population counts for this age group for the purposes of calculating migration rates only. We did not increase the population counts in the projections.

A further problem concerned the relationship between sex ratios in migration rates for dependent children. There exists no theoretical explanation for male and female net rates to be markedly different for persons under age fifteen. Therefore the migration rates used are based on the non-sex-specific number of migrants in the age groups under age fifteen in all counties.

The data indicated a few unexplainable differences in the migration rates of males and females in the same age/race cohort in a few counties. These differences were assumed to be the result of either some short term variation of relatively stable migration patterns or sampling errors that resulted from small sample sizes in age/sex or age/sex/race cohorts in some counties. Therefore, in most counties with populations of fewer than 100,000, non-sex-specific migration rates were used for projection purposes. The exceptions were those counties with special populations (college students, prisons, etc.) that were greater than 5 percent of a sex group in the 1980 Census. In these counties, sex-specific migration rates were maintained, because sex differences in migration rates were expected.

One final problem with these migration data was that in some counties, the migration rate of children age 0-4 was in the opposite direction from all cohorts of the same racial category in the 20-44 age groups. Among whites, this problem occurred when there was an out-migration of parent cohorts and an in-migration of children aged 0-4.[1/] Among nonwhites, the reverse occurred. There exists no literature which demonstrates migration selectivity by parenthood, although this possibility exists. For example, it could be that non-parents in the 20-44 age groups have a net out-migration from a county that is larger than the net in-migration of parents.

1/ While this seems unlikely to occur, earlier migration studies report this pattern in Pennsylvania from 1950-60 and 1960-70. See Bowles and Tarver, 1965 and Bowles and Lee, 1975.

This explanation may be offered for the white differences, and the problem of the undercounts of children 0-4 accounted for some of the nonwhite differences.

In order to eliminate this problem, a strategy similar to that used by the Census Bureau to correct a similar type of problem data was undertaken. In those counties where this problem existed, a nearby county with a similar settlement pattern (suburban, rural, etc.) was chosen as a standard for this adult-to-children migration rate. A correction was accomplished by taking ratios of adult migration rates to 0-4 migration rates in the county taken as the standard and applying the ratio to the same age cohorts in the county with the data errors.

In sum, data from the retrospective question asked on the 1980 Census was used to generate migration rates for persons above age five in each age, sex and race cohort in each county in Pennsylvania. For children below age five, migration rates were calculated by summing the births for the five years prior to census, applying a survival rate to these births and then comparing the result to the actual count in 1980. To increase the validity of the projections, non-sex-specific rates were used for children below age fifteen in all counties and for all age groups in counties below 100,000 population except where a substantial special population existed. Correction to the migration rates of nonwhite children 0-4 were also made to account for underenumeration of this group. With these corrections,

the data contain fewer errors than would be expected with the survival rate methodology for determining migration rates.

STATE AND COUNTY MIGRATION TRENDS

This section describes recent changes in net migration in Pennsylvania and its counties. Analysis of past trends in migration provides not only clues about the evolution of migration change in the Commonwealth but also provides a historical context within which to project future migration patterns. In Table 1, net migration and net migration rates (per 100 population) are provided for the 1965-70 and 1975-80 periods for Pennsylvania counties. These data reveal several recent shifts in Pennsylvania migration patterns.

One shift is that Pennsylvania experienced more net out-migration during the 1975-80 period than during the 1965-70 period. During the 1975-80 period, about 177,803 more persons left the state than moved into Pennsylvania. During the late 1960s, net out-migration was 111,074 persons. As a result, Pennsylvania has been a state of substantial out-migration during the past 20 years, with net out-migration rates between 1.0 and 2.0 per 100 population during this period. This means that 1-2 more persons per 100 resident population moved out than moved into the state during a 5 year period. Although these data suggest that net out-migration has accelerated recently in Pennsylvania, we should point out that the average annual net out-migration during the entire decade of the

Table 1. Pennsylvania Net Migration, Ages 5 and Older: 1965-70 and 1975-80

State and Counties	1965-70		1975-80	
	Rate per 100	Net Migration	Rate per 100	Net Migration
PENNSYLVANIA	-1.02	-111,074	-1.57	-177,803
Adams	.05	24	5.26	3,181
Allegheny	-3.28	-50,477	-4.77	-68,797
Armstrong	-3.37	-2,431	-1.72	-1,268
Beaver	-3.57	-7,115	-3.51	-6,960
Bedford	-5.64	-2,314	.23	98
Berks	1.15	3,134	1.84	5,310
Blair	-2.91	-3,741	-3.03	-3,971
Bradford	1.11	574	-2.66	-1,588
Bucks	8.88	30,744	4.43	18,882
Butler	.54	624	2.36	3,169
Cambria	-3.99	-7,186	-5.17	-9,331
Cameron	-8.32	-590	-8.91	-616
Carbon	-3.23	-1,561	.09	504
Centre	9.01	7,544	12.05	11,499
Chester	9.78	22,800	7.84	21,525
Clarion	-1.28	-459	3.12	1,224
Clearfield	-4.19	-2,985	1.67	1,280
Clinton	.42	144	1.96	702
Columbia	-1.77	-920	-.24	-141
Crawford	.06	42	-2.68	-2,276
Cumberland	7.06	9,618	3.57	5,801
Dauphin	-4.04	-8,718	-1.72	-3,809
Delaware	-.97	-5,400	-4.88	-26,860
Elk	-5.17	-1,860	-1.60	-579
Erie	-.55	-1,317	-4.03	-10,889
Fayette	-4.32	-6,428	-3.62	-5,573
Forest	-3.43	-162	4.37	200

Table 1. (Continued)

State and Counties	1965-70 Rate per 100	1965-70 Net Migration	1975-80 Rate per 100	1975-80 Net Migration
Franklin	2.57	2,312	-.56	-603
Fulton	-3.82	-389	1.99	231
Greene	-.40	-134	3.27	1,185
Huntingdon	-3.70	-1,381	1.94	746
Indiana	3.80	2,677	5.30	4,316
Jefferson	-4.32	-1,829	-.65	-291
Juniata	-2.41	-377	.32	57
Lackawanna	-.86	-1,890	-1.18	-2,560
Lancaster	1.61	4,648	3.09	10,076
Lawrence	-4.07	-4,214	-6.89	-7,439
Lebanon	.55	498	1.20	1,201
Lehigh	2.44	5,626	1.29	3,262
Luzerne	-1.18	-3,808	-1.18	-3,859
Lycoming	-.81	-845	-1.99	-2,241
McKean	-5.16	-2,578	-4.04	-1,990
Mercer	-2.02	-2,421	-2.88	-3,563
Mifflin	-2.64	-1,116	-3.12	-1,403
Monroe	5.69	2,260	16.88	9,413
Montgomery	4.22	23,325	-1.19	-7,317
Montour	-1.81	-283	-3.54	-574
Northampton	1.68	3,288	1.19	2,670
Northumberland	-6.02	-5,881	-2.92	-2,835
Perry	-1.91	-511	3.34	1,062
Philadelphia	-4.89	-92,043	-6.57	-111,221
Pike	10.13	942	25.43	3,500
Potter	-1.50	-195	-4.72	-811
Schuylkill	-4.29	-6,523	-2.56	-3,985
Snyder	3.13	699	4.06	1,212
Somerset	-4.10	-2,591	.20	153
Sullivan	-5.59	-257	.94	56

Table 1. (Continued)

State and Counties	1965-70		1975-80	
	Rate per 100	Net Migration	Rate per 100	Net Migration
Susquehanna	-2.75	-767	-1.63	-580
Tioga	1.57	474	-2.11	-821
Union	6.86	1,524	13.95	3,769
Venango	-1.57	-878	-2.86	-1,757
Warren	-.22	-92	-3.09	-1,410
Washington	-2.81	-5,464	-.79	-1,631
Wayne	-.26	-60	1.03	334
Westmoreland	.02	52	.23	833
Wyoming	9.13	1,300	.37	89
York	1.72	4,234	2.69	7,678

1960s exceeded the average annual net out-migration in the late 1970s. During the 1960s, average annual net out-migration was nearly-38,000 (Bowles and Lee, 1975), compared to about-35,200 during the 1975-80 period.

Although Pennsylvania as a whole has experienced substantial net out-migration over the past 20 years, it would be a mistake to conclude that population loss through net out-migration is shared by all Pennsylvania counties. Indeed, as illustrated in Table 1, there is a wide assortment of migration patterns and trends during the 1965-70 and 1975-80 periods. Some counties have been big gainers; others big losers.

Net Out-migration from Philadelphia and Pittsburgh

One important migration pattern---and one that has a major effect on state patterns---is the unprecedented net out-migration from the state's most populated metropolitan areas. The U.S. as a whole experienced population decline in the largest metropolitan cities during the past decade, a consequence of the massive exodus to suburban and nonmetropolitan counties. This pattern has not escaped Pennsylvania. During the late 1970s, Allegheny County, which includes Pittsburgh, and Philadelphia County, experienced net out-migration of about-69,000 and-111,000 respectively. Out-migration on this scale played a major role in the absolute population decline during the 1970s in both Pittsburgh and Philadelphia. Moreover, the net out-migration of 180,000 in these two

counties represented more net out-migration than that which occurred for the state as a whole. In fact, during the late 1970s, the balance of the state experienced slight in-migration.

Net Migration for Suburban Counties

Another demographic feature of the state is the rapid suburbanization during the past 20 years. Again this is consistent with national trends. For example, Bucks and Chester counties---part of the Philadelphia metropolitan statistical area---each experienced substantial net in-migration, both in number of net migrants and rates of net in-migration. However, like national trends, net in-migration in these counties slowed over the 1975-80 period. For example, Bucks County experienced a decline in net in-migration from nearly 9 persons per 100 in 1965-70 to about 4.5 per 100 during the 1975-80 period.

Contrary to national trends, however, the suburban counties near Allegheny County have not shared significantly in the massive in-migration characteristic of many metropolitan suburban areas in the U.S. Indeed, Westmoreland, Washington, and Beaver counties experienced net out-migration during the late 1970s. This suggests that the net out-migration from Allegheny County during the recent past was not due solely to a reshuffling of population within the larger metropolitan Pittsburgh area. Rather it reflects the fact that the metropolitan area as a whole lost people to other counties within the state and to other states.

Net Migration for Nonmetropolitan Counties

Another pattern worth pointing out is the resurgence of net in-migration in many remote or nonmetropolitan counties in the state during the 1970s. This is evident by the turnaround from net out-migration during the late 1960s to net in-migration in the late 1970s in some counties (e.g., Bedford, Clarion, Clearfield, Forest, Fulton, Greene, Huntingdon, Juniata, Perry, Sullivan, Somerset, and Wayne), or by an acceleration in the 1970s of net in-migration compared to the 1960s (e.g., Adams, Butler, Clinton, Indiana, Monroe, Pike, Snyder, and Union). This resurgence in the 1970s of net in-migration in the state's least populated counties is similar to the pattern for the U.S. as a whole. However, this "rural resurgence" may have been short-lived, for recent evidence on national trends (e.g., Forstall and Engels) and data presented later in this report suggest that patterns in the early 1980s exhibit diminished net in-migration in many of these counties.

White and Nonwhite Migration

Net in-migration patterns in Pennsylvania and its counties also exhibit substantial variation between whites and nonwhites. In Table 2, net migration and net migration rates are provided for whites and nonwhites in Pennsylvania and the 18 counties in the state with nonwhite populations of 5000 or more in 1980. Several interesting patterns of racial change emerge from these data.

Table 2. Pennsylvania Net Migration,* Ages 5 and Older, Whites and Nonwhites: 1965-70 and 1975-80

	1965-70				1975-80			
	White		Nonwhite		White		Nonwhite	
	Rate per 100	Net Migration	Rate per 100	Net Migration	Rate per 100	Net Migration	Rate per 100	Net Migration
PENNSYLVANIA	-1.23	-123,579	1.39	12,505	-1.73	-177,100	-.07	-703
Allegheny	-3.41	-47,807	-1.94	-2,670	-5.43	-70,263	1.00	1,466
Beaver	-3.65	-6,868	-2.23	-247	-3.17	-5,903	-8.59	-1,057
Berks	1.04	2,751	6.21	383	1.45	4,057	16.42	1,253
Bucks	8.92	30,197	7.21	547	4.02	16,695	20.06	2,187
Chester	10.45	22,346	2.35	454	7.74	19,557	9.10	1,968
Dauphin	-4.84	-9,316	2.55	598	-2.40	-4,563	2.42	754
Delaware	-.29	-1,465	-8.72	-3,935	-5.83	-29,233	4.93	2,373
Erie	-.62	-1,446	1.65	129	-4.29	-11,074	1.56	185
Fayette	-4.21	-5,981	-6.73	-437	-3.49	-5,139	-6.41	-434
Lancaster	1.55	4,399	5.26	249	2.71	8,608	19.65	1,468
Lehigh	2.16	5,345	11.11	281	.90	2,395	19.40	844
Mercer	-1.81	-2,078	-6.78	-343	-2.76	-3,258	-5.13	-305
Montgomery	4.39	23,292	.15	33	-2.33	-13,609	20.63	6,292
Northampton	1.51	3,146	3.76	142	-.10	2,664	1.40	6
Philadelphia	-8.59	-111,895	3.43	19,852	-8.17	-86,353	-3.91	-24,868
Washington	-2.64	-4,936	-6.74	-528	-.87	-1,740	1.55	109
Westmoreland	.14	448	-6.12	-396	.25	896	-.85	-63
York	1.71	4,077	2.35	157	2.37	6,545	12.45	1,133

* Counties with 5000 or more nonwhite population in 1980.

First, at the state level, nonwhites experienced net in-migration during the 1960s (12,505 net in-migrants), whereas whites experienced substantial net out-migration. By the late 1970s, both whites and nonwhites experienced net out-migration. However, the net out-migration rate for nonwhites was considerably lower (-.07 per 100 population) than the white rate (-1.73). In addition to higher nonwhite fertility, less nonwhite out-migration had the effect of increasing the percent nonwhite in the state population.

The data in Table 2 also reveal considerable racial variation in net migration rates for Pennsylvania counties with 5000 or more nonwhites. As expected, all of these counties (except Fayette) were classified in 1980 as metropolitan by the Census Bureau. Relatively few blacks reside in Pennsylvania's nonmetropolitan and rural areas. This pattern is similar to the non-South as a whole; over 95 percent of U.S. blacks outside the South reside in metropolitan areas.

Not unlike the migration patterns for the total population described earlier, both Allegheny and Philadelphia Counties experienced considerable net out-migration of whites during the 1960s and 1970s. The pattern for nonwhites, however, was somewhat different. In Allegheny County, the pattern of net out-migration during the late 1960s was replaced by slight net in-migration during the late 1970s. Conversely, Philadelphia County replaced a 1965-70 pattern of nonwhite net in-migration with net out-migration in the late 1970s.

Part of the reason for the substantial out-migration of nonwhites in Philadelphia County in the 1970s lies in the rapid nonwhite suburbanization in adjacent counties. Nonwhite net in-migration in Bucks (20.06), Chester (9.10), Delaware (4.93), and Montgomery (20.63) Counties during 1975-80 was substantial and, indeed, exceeded white net in-migration. As a result increased racial heterogeneity in the Philadelphia suburbs is apparent. This rapid suburbanization of nonwhites is again consistent with national trends (Long and DeAre, 1981).

This pattern of substantial nonwhite suburbanization around Philadelphia contrasts with the pattern observed in the Pittsburgh metropolitan area. Beaver (-8.59), Washington (1.53), and Westmoreland (-.85) all experienced either slow rates of nonwhite net in-migration or net out-migration. This again reflects the the decline in population caused by net out-migration from the broader Pittsburgh metropolitan area.

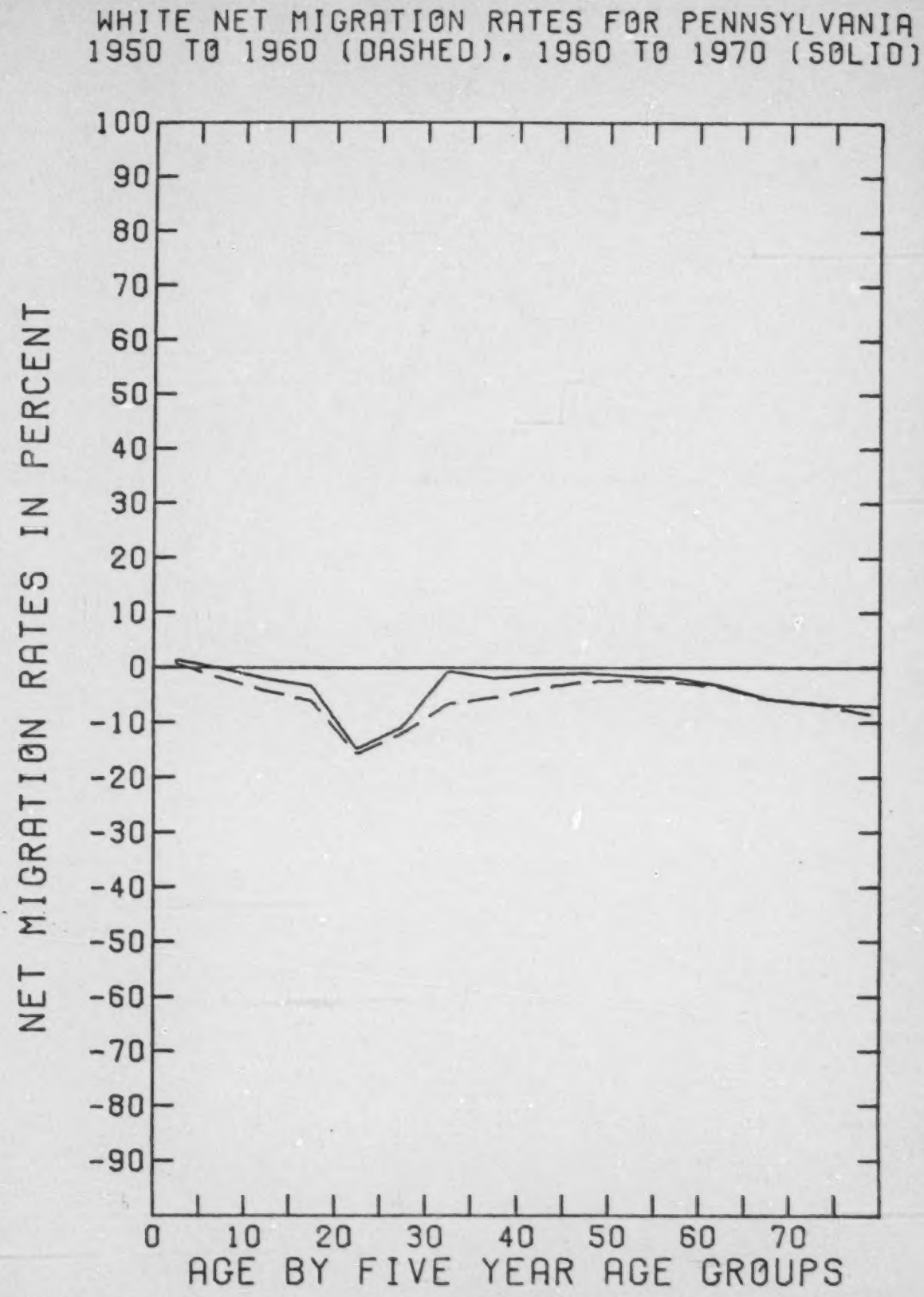
The pattern of white and nonwhite net migration in Pennsylvania's smaller metropolitan areas also exhibits substantial nonwhite in-migration compared to that for whites. For example, Dauphin and Erie Counties experienced white net out-migration but net in-migration of nonwhites during the 1965-70 and 1975-80 periods. Berks, Lancaster, and York Counties, although experiencing net in-migration for both whites and nonwhites, nevertheless showed much higher nonwhite than white net in-migration during both the 1965-70 and 1975-80 periods.

THE STABILITY OF THE AGE PATTERN OF NET MIGRATION

In this section, we examine the stability in age migration patterns over time using the retrospective question from the 1980 Census to calculate net migration rates. Previous research (Bowles and Tarver, 1965, and Bowles and Lee, 1975) demonstrated that the age-specific distribution of net migration rates was relatively similar during the 1950-60 and the 1960-70 periods. These rates were calculated using a survival rate methodology and their stability may have resulted from the method and the ten-year period as well as actual migration behavior.

Figure 1 presents the ten year net migration rates by age for white Pennsylvanians for the 1950-60 and the 1960-70 periods. These data show that in both periods, there was net out-migration at all ages over age 5. They also demonstrate that the peak period of out-migration was at the 20-24 age group and that out-migration decreases in the following age groups and then increases slightly after age 60. The two lines are fairly parallel except for the 25-29 age group where the difference may have resulted from military migration in the Viet Nam war period. Figure 2 presents nonwhite migration rates for the same periods. While there was in-migration of nonwhites to Pennsylvania as contrasted to the out-migration of whites, the age pattern of the net migration of nonwhites was also quite similar for 1950-60 and 1960-70.

The interpretation of these data is that while the <u>amount</u> of migration may have changed between periods, there was little change


WHITE NET MIGRATION RATES FOR PENNSYLVANIA
1950 TO 1960 (DASHED). 1960 TO 1970 (SOLID)
NET MIGRATION RATES IN PERCENT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
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10
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60
70
AGE BY FIVE YEAR AGE GROUPS

FIGURE 1

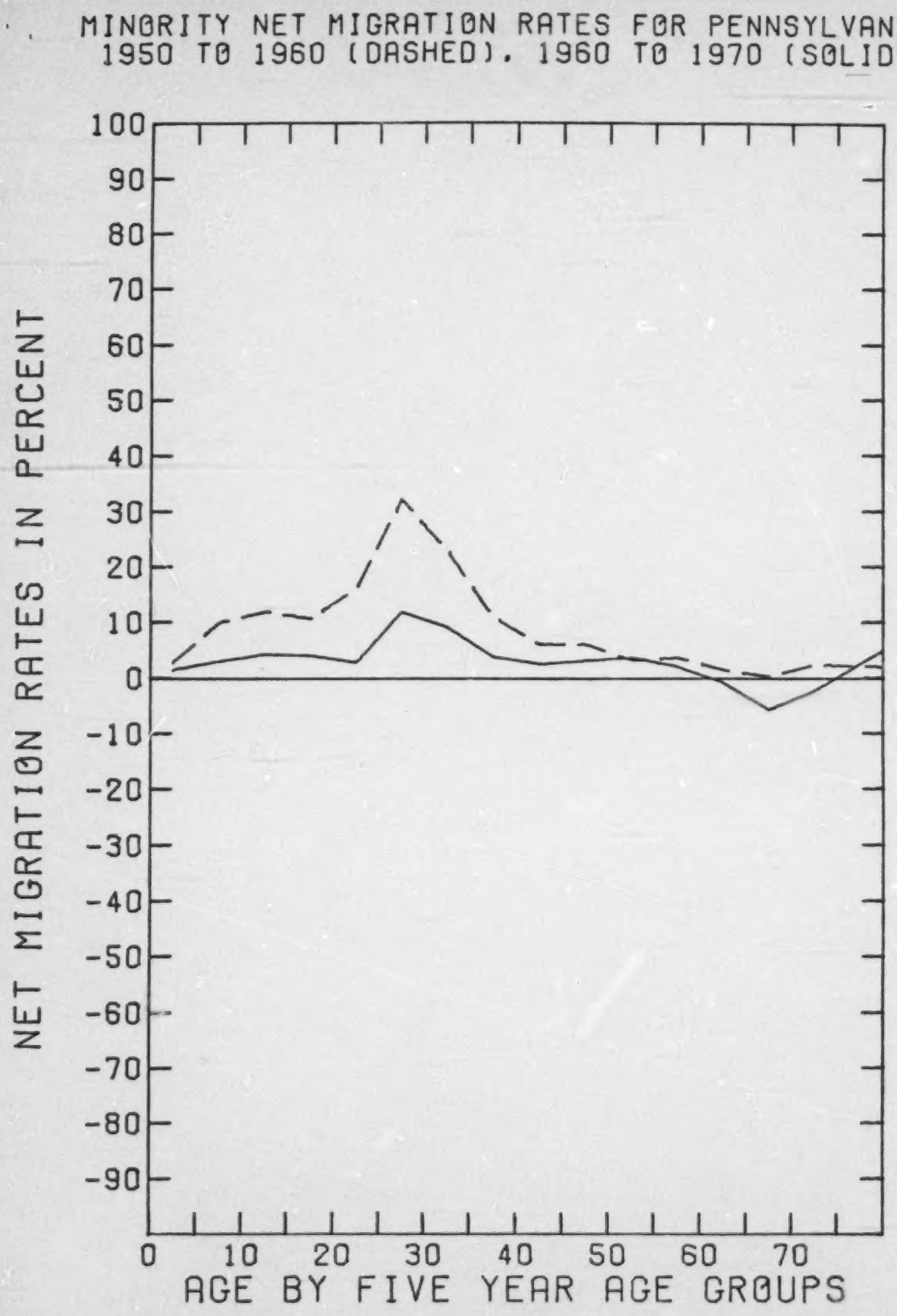
MINORITY NET MIGRATION RATES FOR PENNSYLVANIA
1950 TO 1960 (DASHED), 1960 TO 1970 (SOLID)
NET MIGRATION RATES IN PERCENT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
0
10
20
30
40
50
60
70
AGE BY FIVE YEAR AGE GROUPS

FIGURE 2

in the age pattern of migrants. For whites, when there was less out-migration between 1960-70 than there was in the previous decade, the entire line shifted upwards but the age pattern remained much the same. Similarly for nonwhites, the decrease in the amount of in-migration in the decade of the 1960s resulted in less in-migration in all age groups, even to the point of the older age groups shifting from net in-migration to net out-migration. Thus the age pattern remained quite stable.

The question remains as to the stability of the migration rates based on the Census question concerning the residence of the persons five years prior to the Census date. The five year retrospective question on migration has been asked in the 1960, 1970, and the 1980 Censuses. Data are available only for the latter two Censuses. Figures 3 and 4 present data for white and nonwhite Pennsylvanians for the 1965-70 and 1975-80 five year retrospective migration question.[2/] These data again show the stability in the age pattern of migration rates. Both whites and nonwhites have a similar age structure in migration rates from 1965-70 and 1975-80. These data further support the conclusion that the age structure of migration is relatively stable and that projections of migration rates with a stable age pattern should be relatively accurate.

A comparison of the two white figures and the two nonwhite figures shows two patterns that emerge for each group. For whites,

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2/ Note that the data in Figures 1 and 2 are for a ten year period and are presented in percentages. Figures 3 and 4 are for a five year period and are in decimals.

WHITE MIGRATION RATES BY AGE IN PENNSYLVANIA

(SOLID = 1965 - 1970 DASHED = 1975 - 1980)

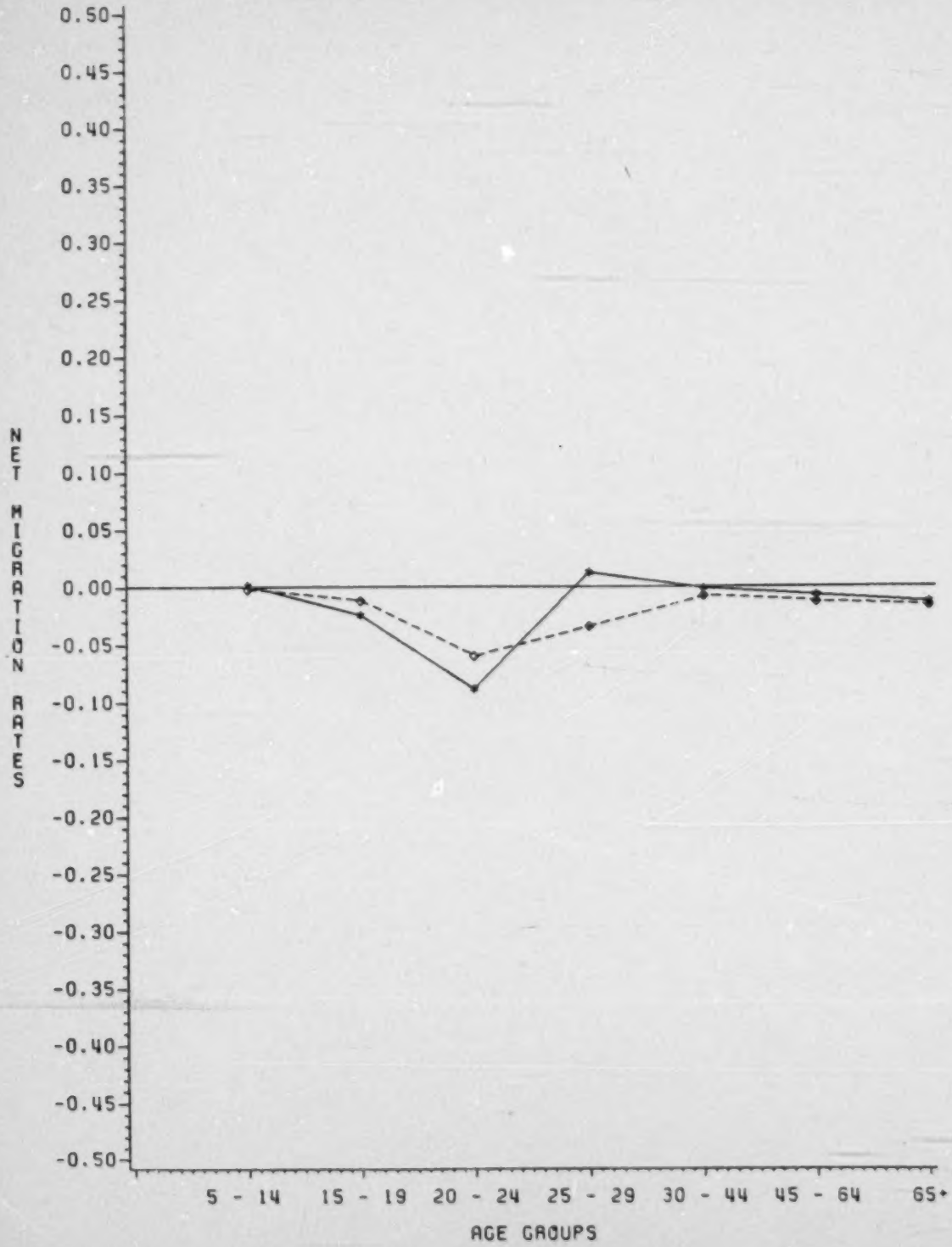


FIGURE 3

NONWHITE MIGRATION RATES BY AGE IN PENNSYLVANIA

(SOLID = 1965 - 1970 DASHED = 1975 - 1980)

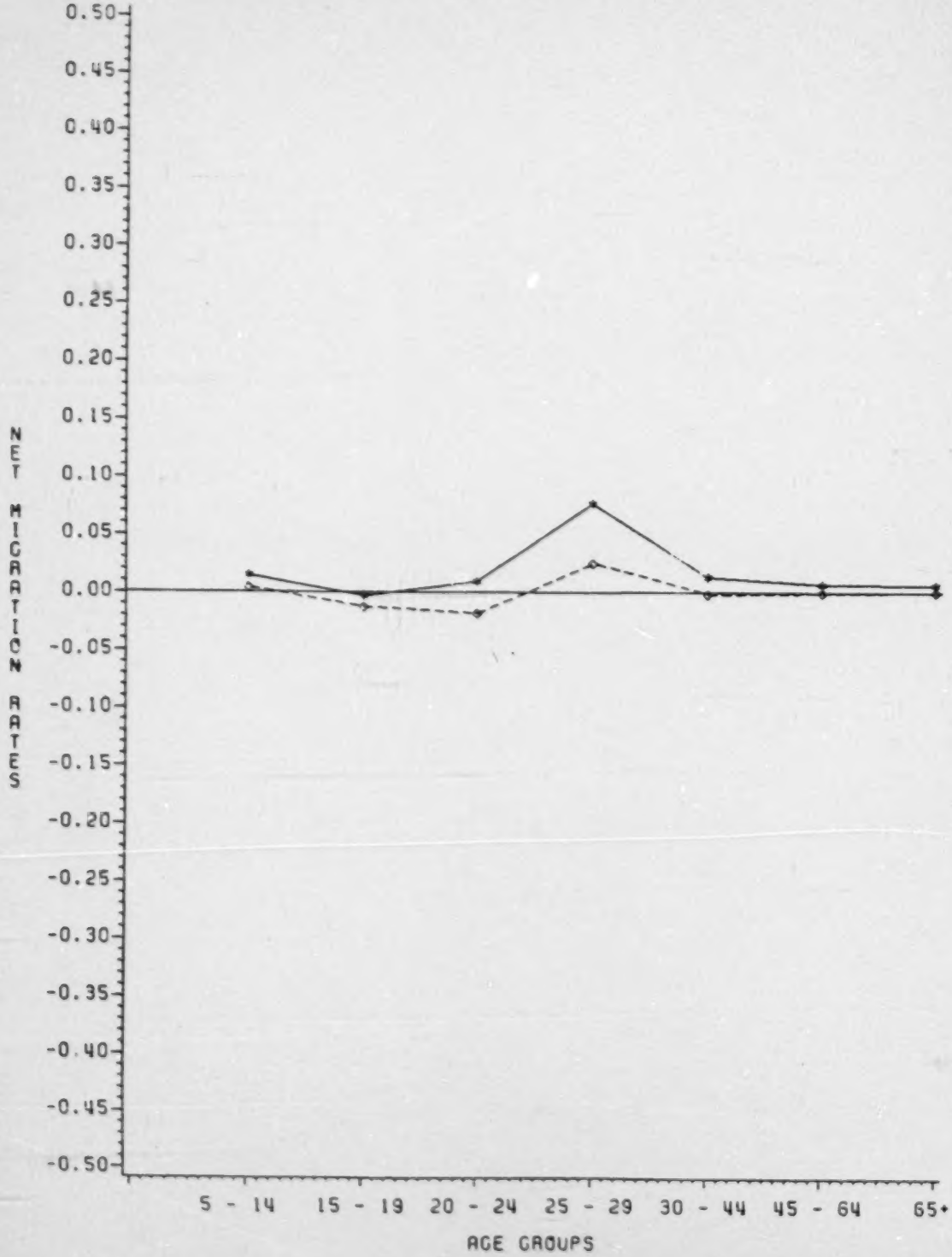


FIGURE 4

there has been a decrease in the rates of out-migration for each age group over the period from 1950 to 1980. For nonwhites, the pattern is one of decreasing rate of in-migration over this same period, to where the net migration rate for most nonwhite age groups was negative in the 1975-80 period. Since whites are about 91 percent of the population of Pennsylvania, it could be expected that the overall amount of out-migration from the state should continue to decrease in the future.

The retrospective five year question appears to be a reasonably consistent measure of the age structure of migration for the entire state. But is this also true for counties? Figures 5 and 6 present the white net migration rates for the two largest counties in Pennsylvania. In both Philadelphia and Allegheny Counties, the age pattern of migration has remained relatively stable for 1965-70 and 1975-80. These figures indicate the data from the Census question is again consistent for counties with large populations.

Philadelphia and Allegheny Counties have experienced out-migration for some time and the stability in the age structure of rates reflects this condition. In other counties, where there have been changes in the settlement patterns, the migration pattern may be less stable. Figure 7 presents the migration rate data for Bucks County. As can be seen, there was an extremely high in-migration rate of persons aged 25-29 in 1965-70, a period of high suburbanization in the county. By the 1975-80 period, suburbanization had decreased, and the sharp migration peak in the 25-29

WHITE NET MIGRATION RATES IN PHILADELPHIA COUNTY

(SOLID = 1965 - 1970 DASHED = 1975 - 1980)

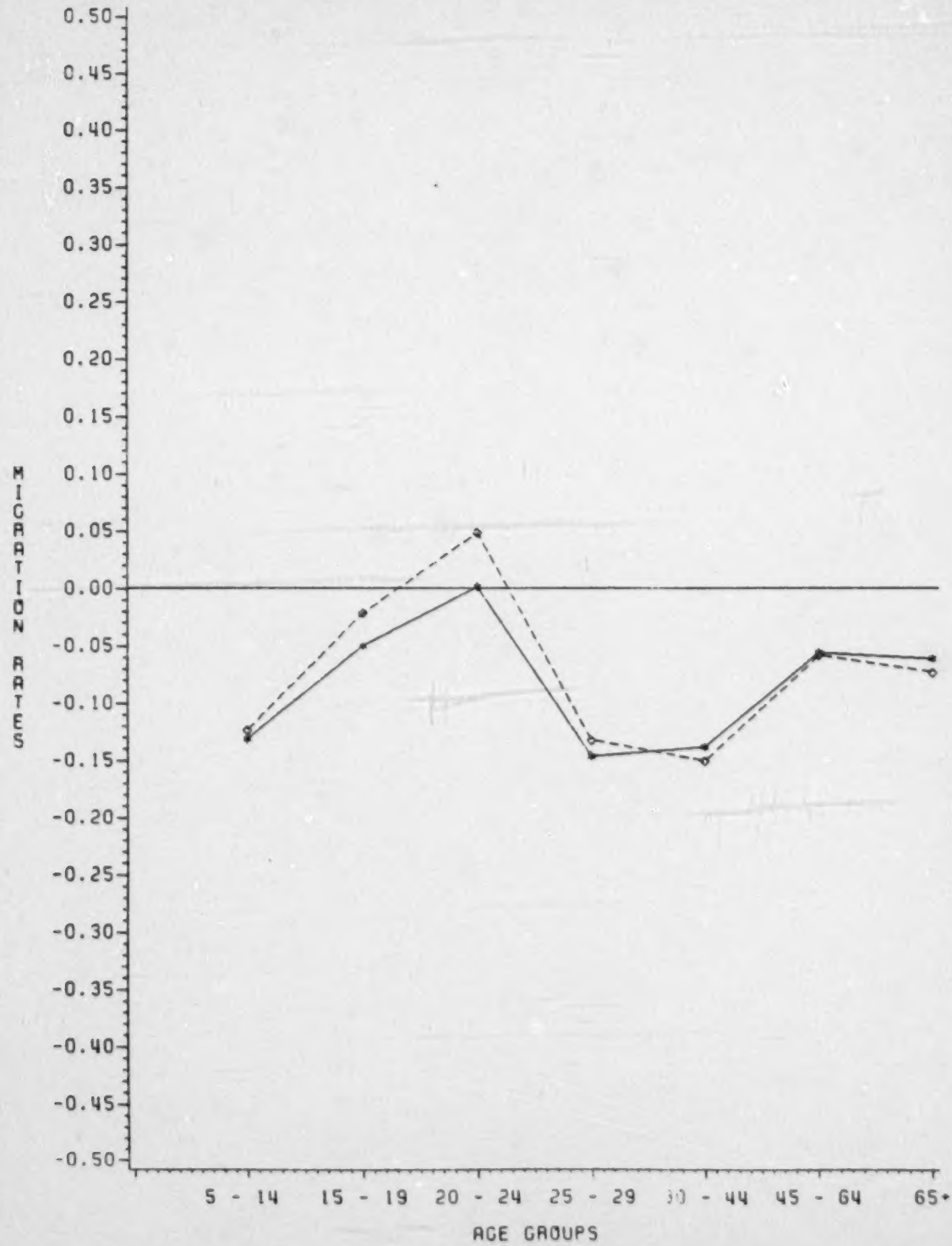


FIGURE 5

WHITE NET MIGRATION RATES IN ALLEGHENY COUNTY

(SOLID = 1965 - 1970 DASHED = 1975 - 1980)

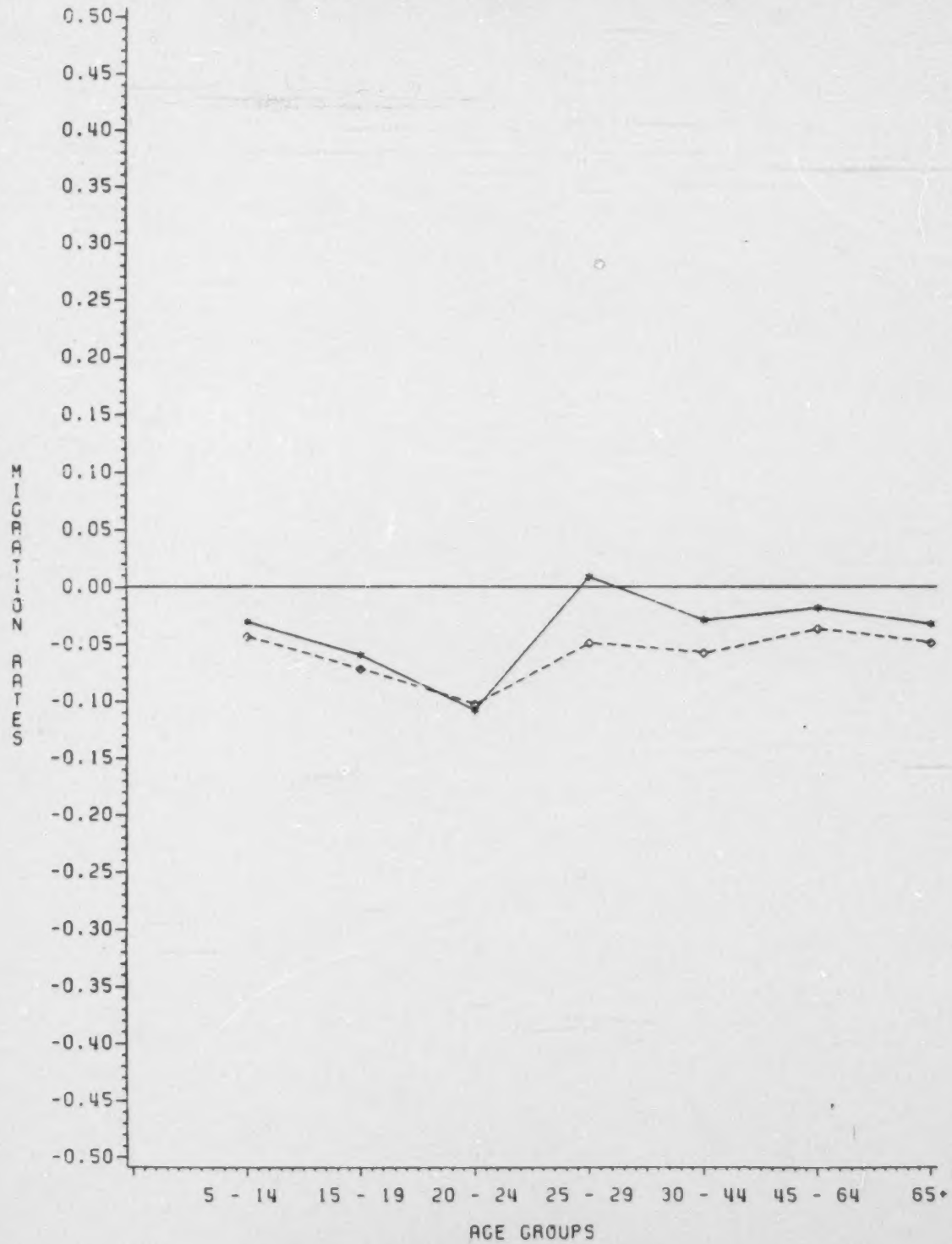


FIGURE 6

WHITE NET MIGRATION RATES IN BUCKS COUNTY

(SOLID = 1965 - 1970 DASHED = 1975 - 1980)

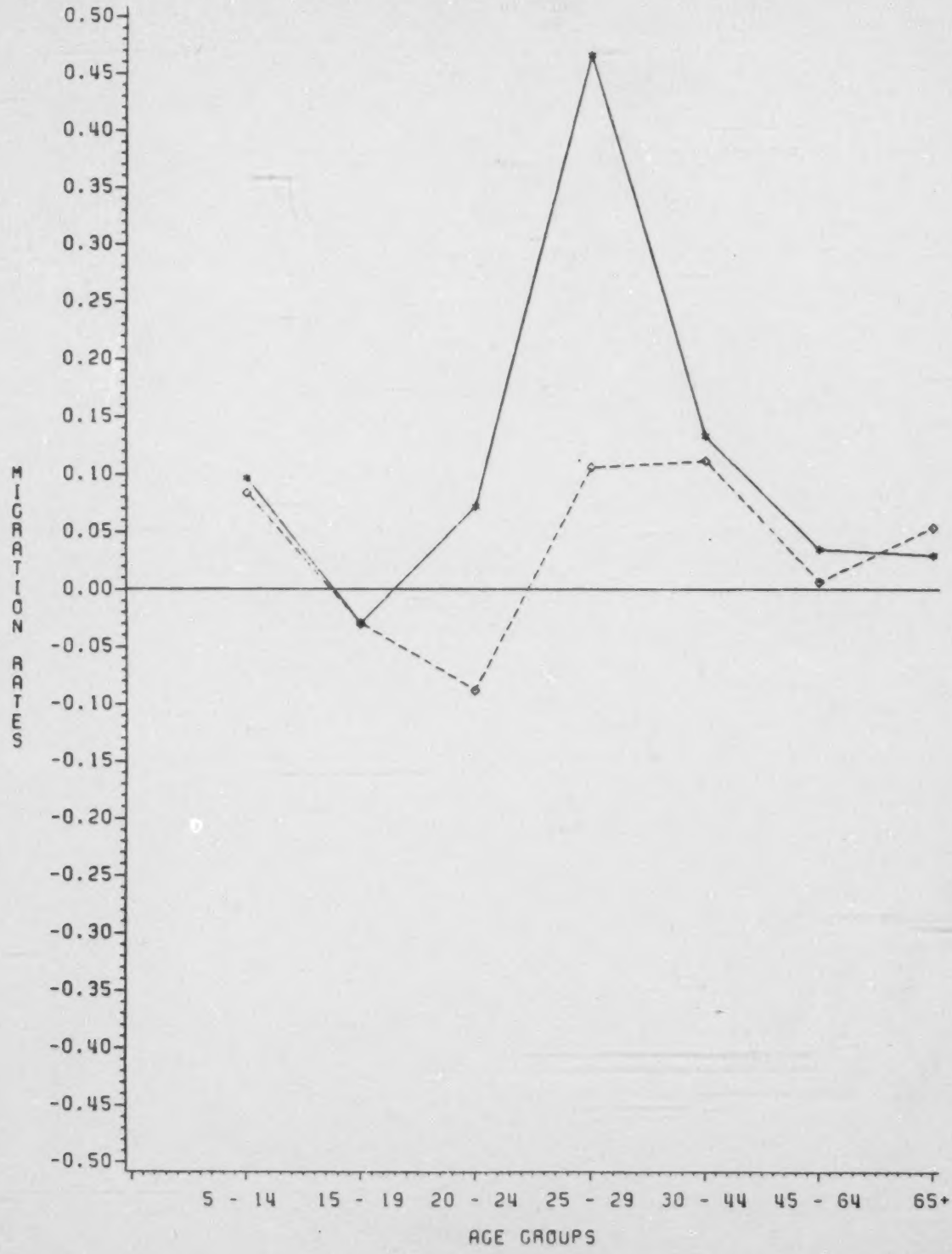


FIGURE 7

NET MIGRATION RATES BY AGE IN PIKE COUNTY

(SOLID = 1965 - 1970 DASHED = 1975 - 1980)

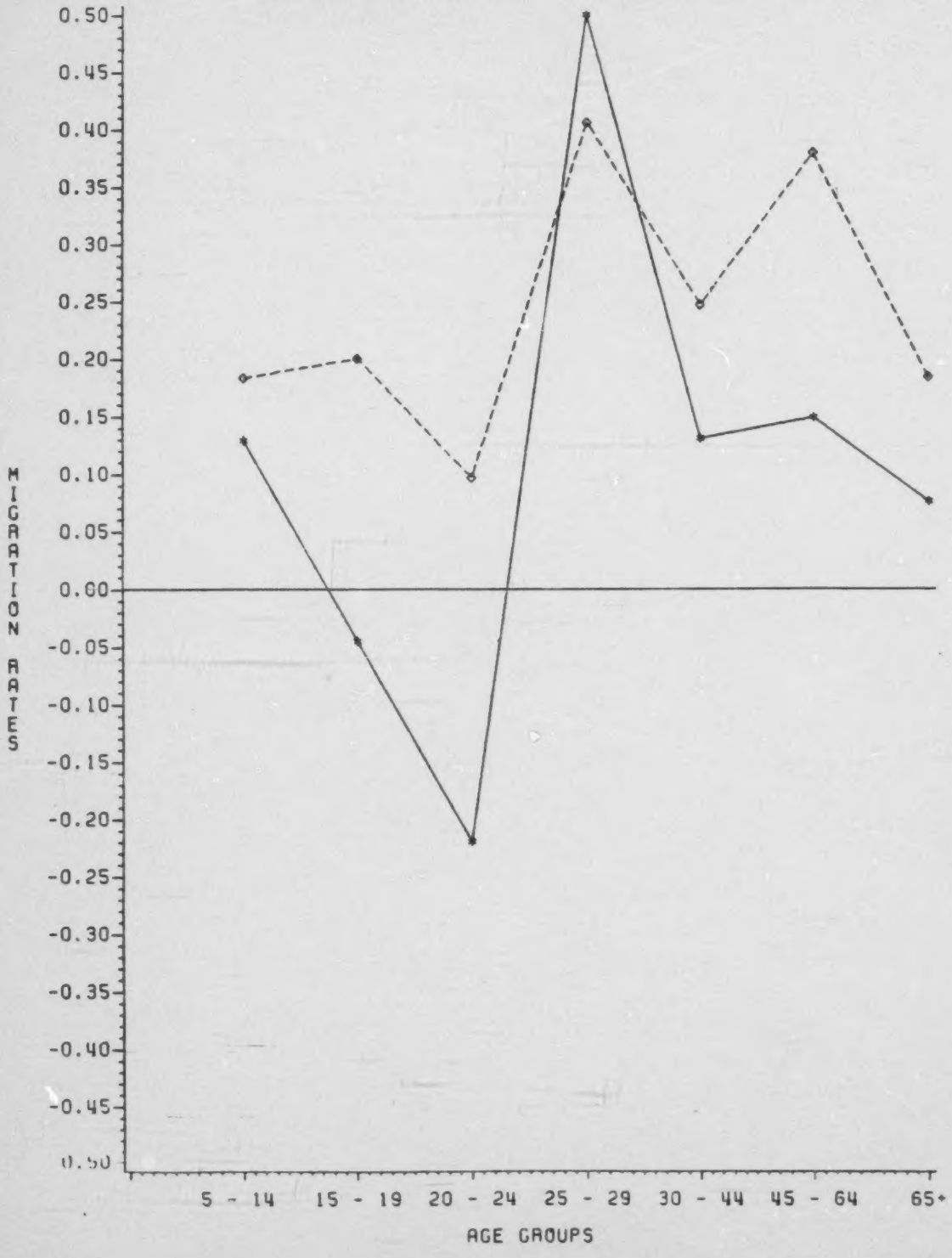


FIGURE 8

NET MIGRATION RATES BY AGE IN ELK COUNTY

(SOLID = 1965 - 1970 DASHED = 1975 - 1980)

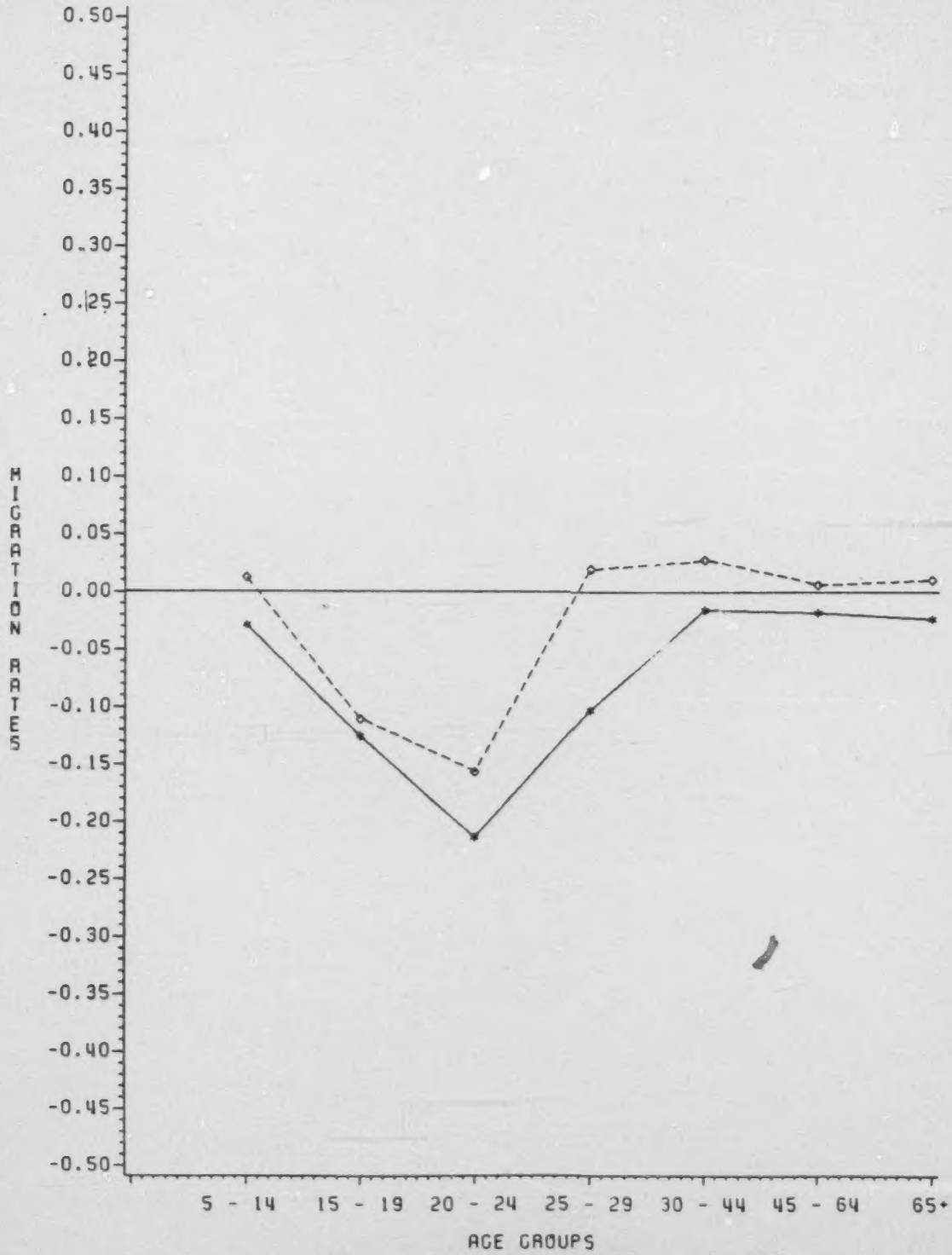


FIGURE 9

age period was reduced. Bucks county is not expected to return to the suburbanization rates of the late 1960s.

During the 1970s, the counties which grew most rapidly were the Pocono resort counties. The value of amenities such as mountains and lakes as inputs to residential location decisions meant that these counties were increasingly attractive to persons of all ages. Figure 8 shows the migration age specific rates for Pike County. By the 1975-80 period this pattern of net in-migration rates for all age groups is apparent.

The question of the stability in the age structure of migration rates is further analyzed by data from Elk County (Figure 9) which changed from net out-migration to net in-migration in some age groups from 1965-70 to 1975-80. As was the case in the other counties, the lines are roughly parallel with the 1975-80 line being less negative. The decreased net out-migration did not occur in only the age group that had the highest rate but in all age groups.

In summary, the data show that there is substantial stability in the age pattern of migration rates for Pennsylvania and the counties. Thus the projection model uses the state and county-level 1975-80 age-specific migration pattern in future projection cycles to the year 2000.

PENNSYLVANIA MIGRATION IN THE EARLY 1980s

In the preceding sections of this report we presented evidence on 1) the stability in the age pattern of migration for not only

the state of Pennsylvania but its counties, and 2) the changing level or magnitude of net migration between the late 1960s and the late 1970s. Since population projections as opposed to population forecasts are based on the changing trends in fertility, mortality, and migration, it is important to analyze the most recent information available on the changing levels of net migration. The key question becomes: What has happened to net migration in Pennsylvania in the early 1980s?

The IRS Migration Data

When Revenue Sharing became a reality in the early 1970s, one of the criteria for distribution of funds was the current population of the political unit. As a result, accurate and timely population estimates were necessary. The Census Bureau began producing estimates for local areas in the mid-1970 to meet this demand. The migration component of these estimates is derived from data provided by the Internal Revenue Service which contains the number of income tax returns including exemptions which were filed from different counties or states. These unique administrative records, while not free of error, provide a reasonably good picture of recent migration trends from 1978 to the most recent available data in 1983. Figures 10 though 15 display recent net migration trends for Pennsylvania and a few sample counties. Figure 10 which presents net migration for the state of Pennsylvania between 1978 and 1983, shows that net out-migration continued during this time period, declining perhaps

ESTIMATED NET MIGRATION IN PENNSYLVANIA

1978-1983

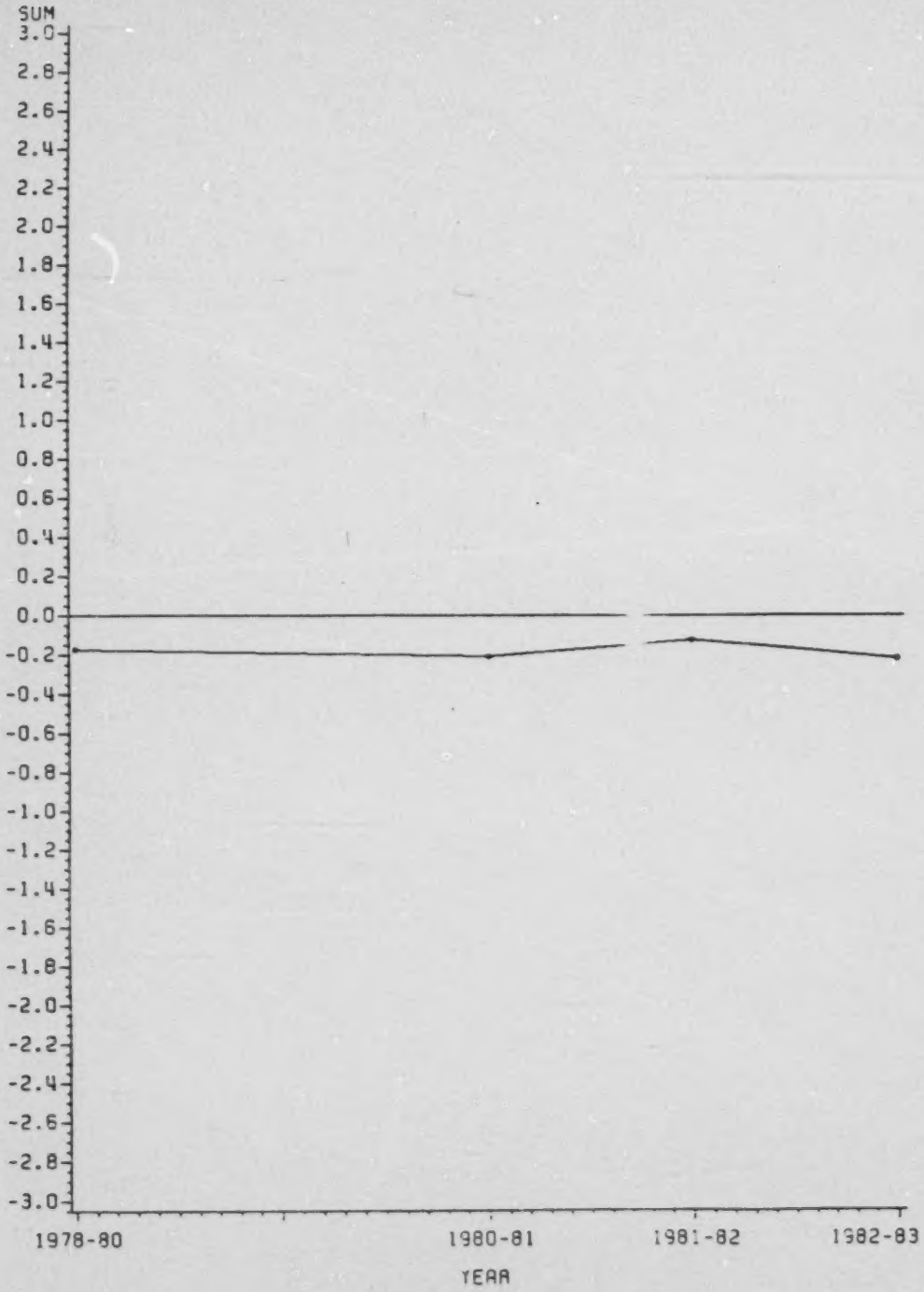


FIGURE 10

ESTIMATED NET MIGRATION IN PHILADELPHIA COUNTY
1978-1983

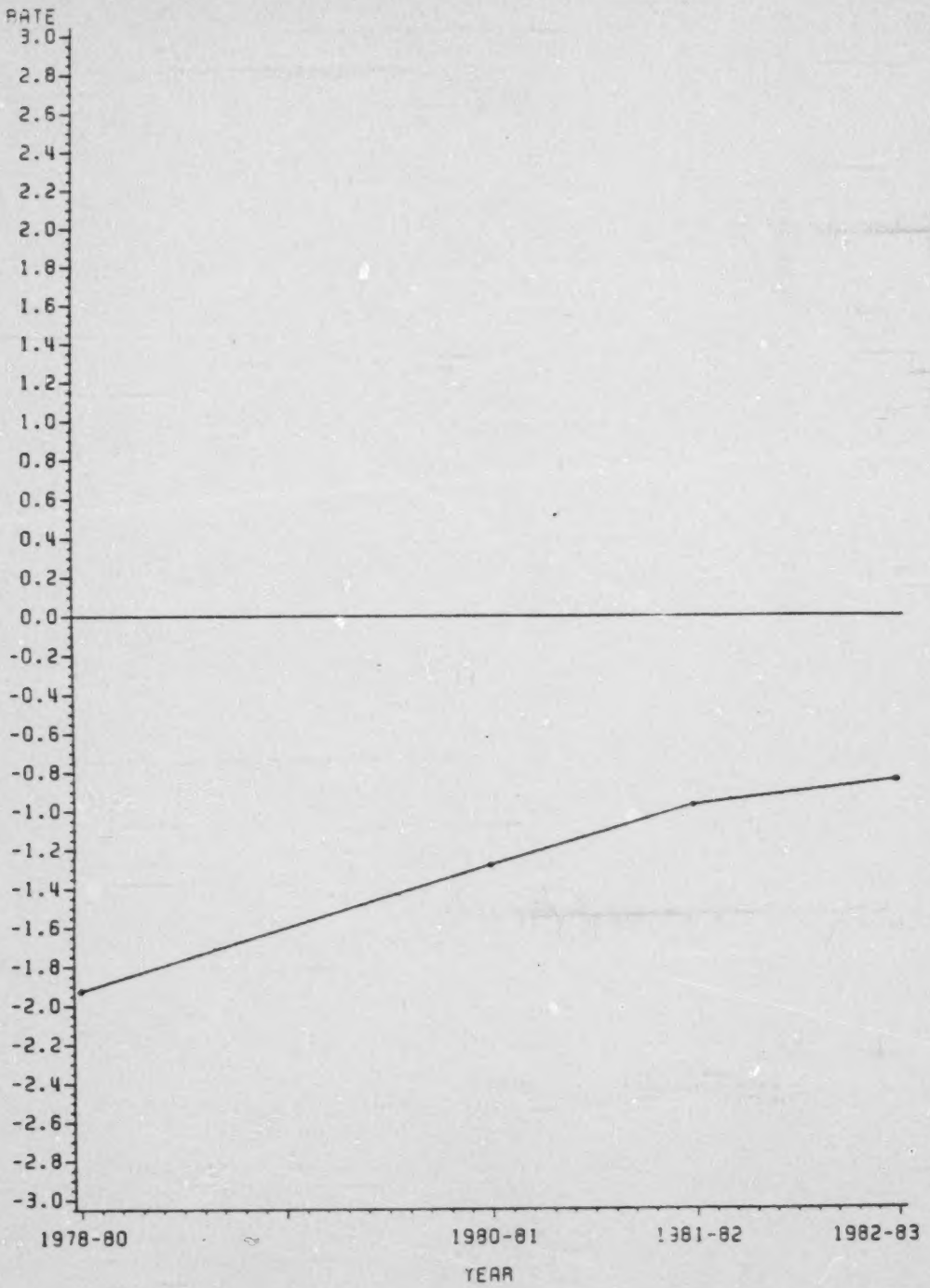


FIGURE 11

ESTIMATED NET MIGRATION IN ALLEGHENY COUNTY
1978-1983

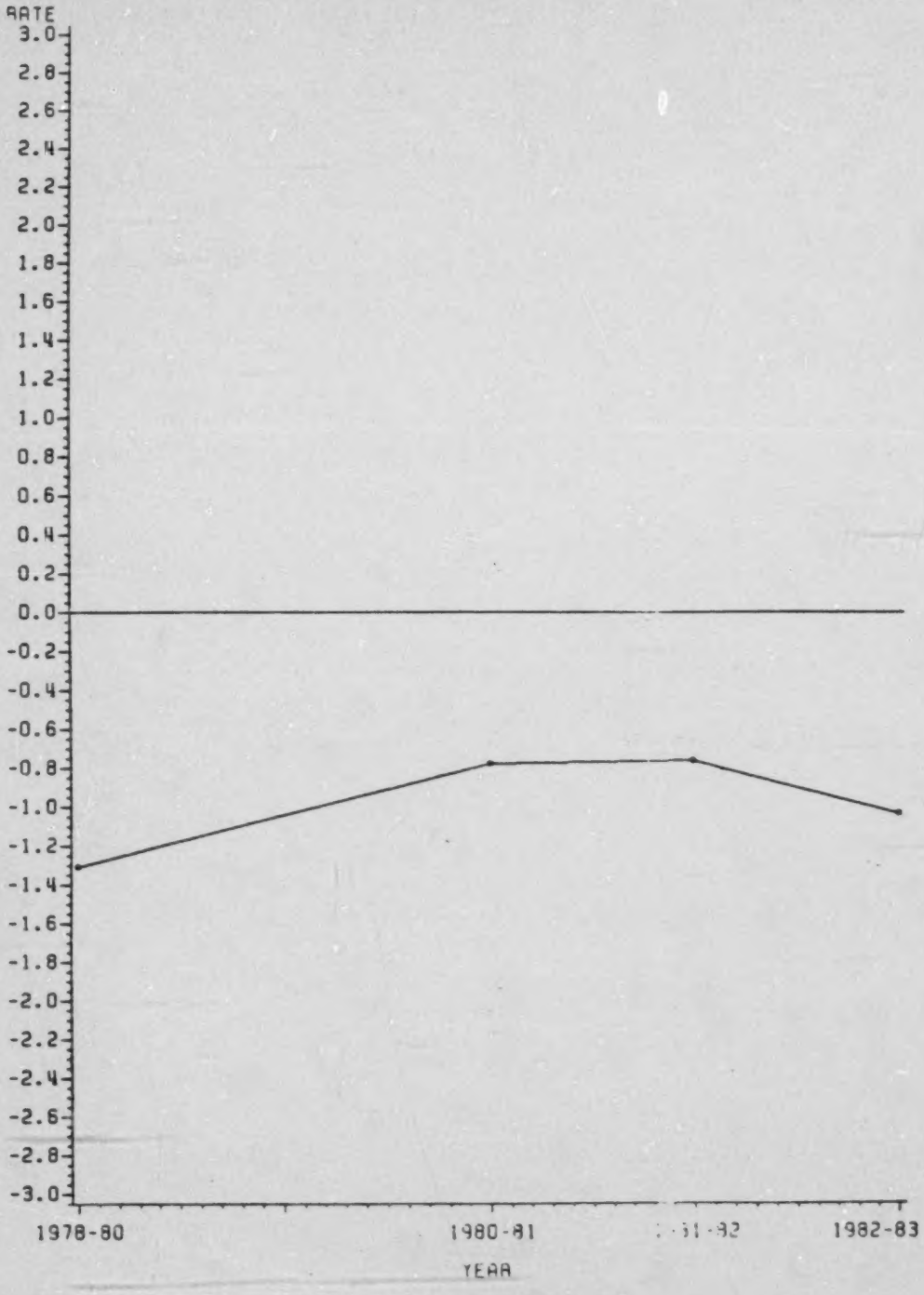


FIGURE 12

ESTIMATED NET MIGRATION IN BUCKS COUNTY

1978-1983

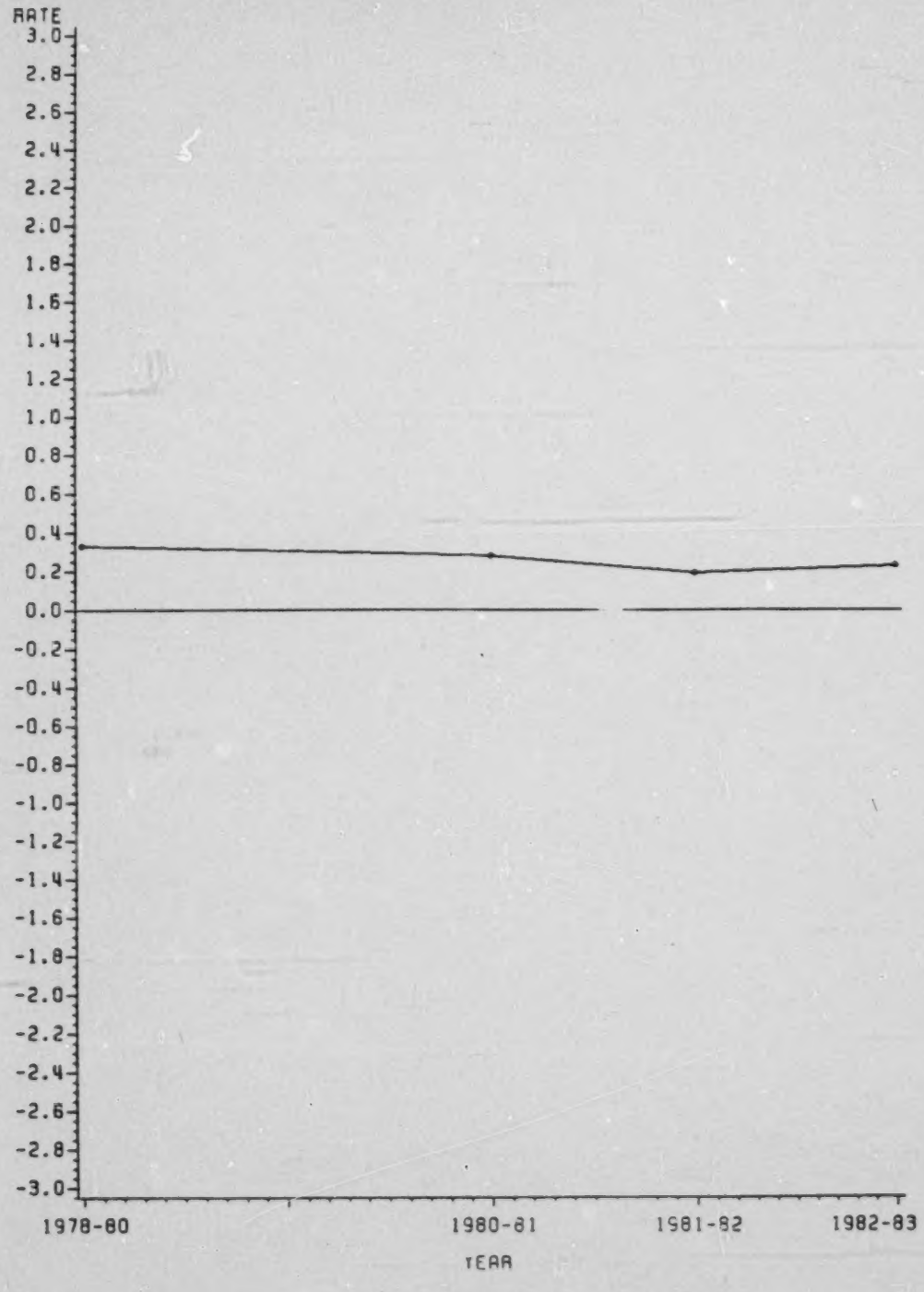


FIGURE 13

ESTIMATED NET MIGRATION IN PIKE COUNTY

1978-1983

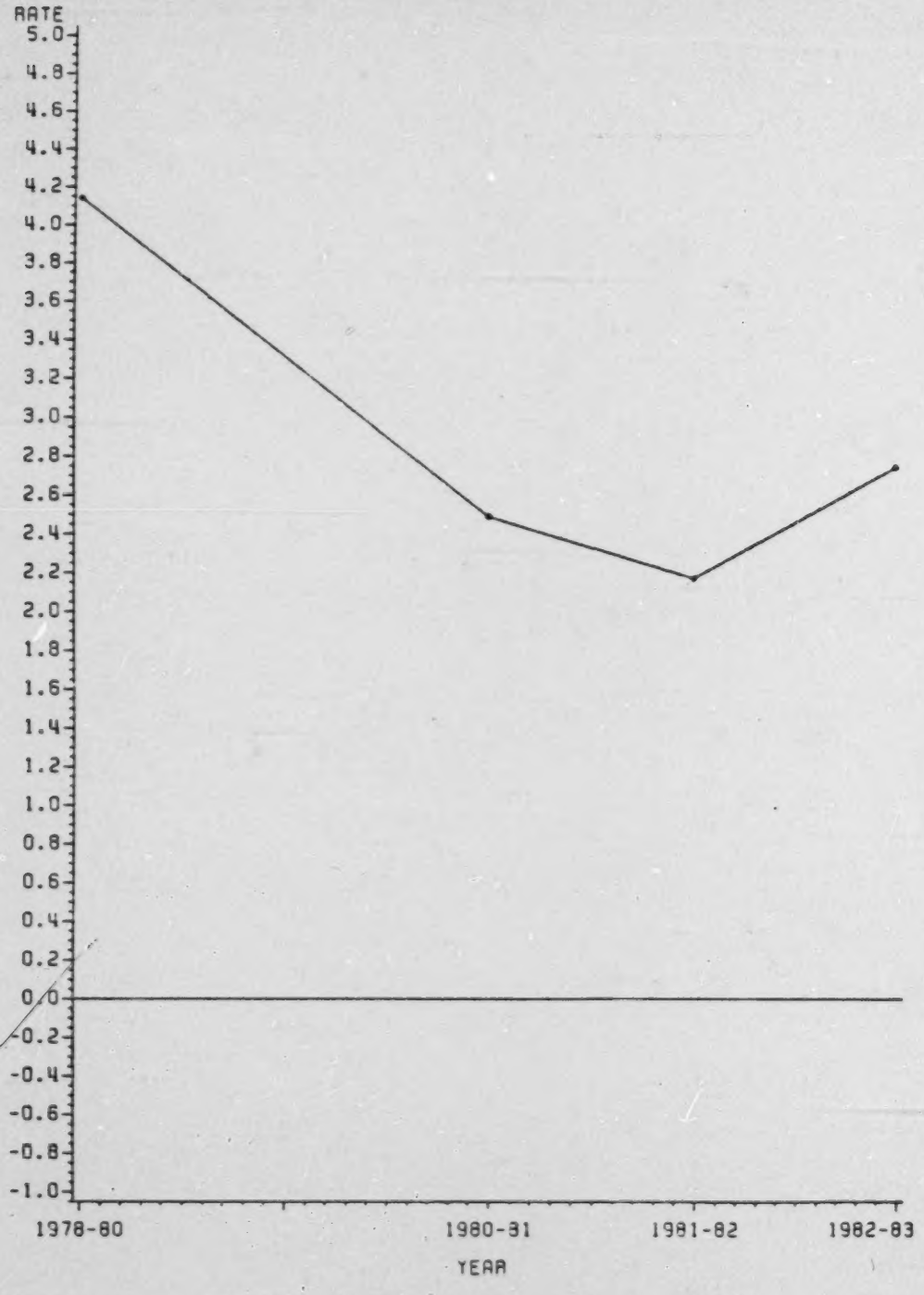


FIGURE 14

ESTIMATED NET MIGRATION IN ELK COUNTY

1978-1983

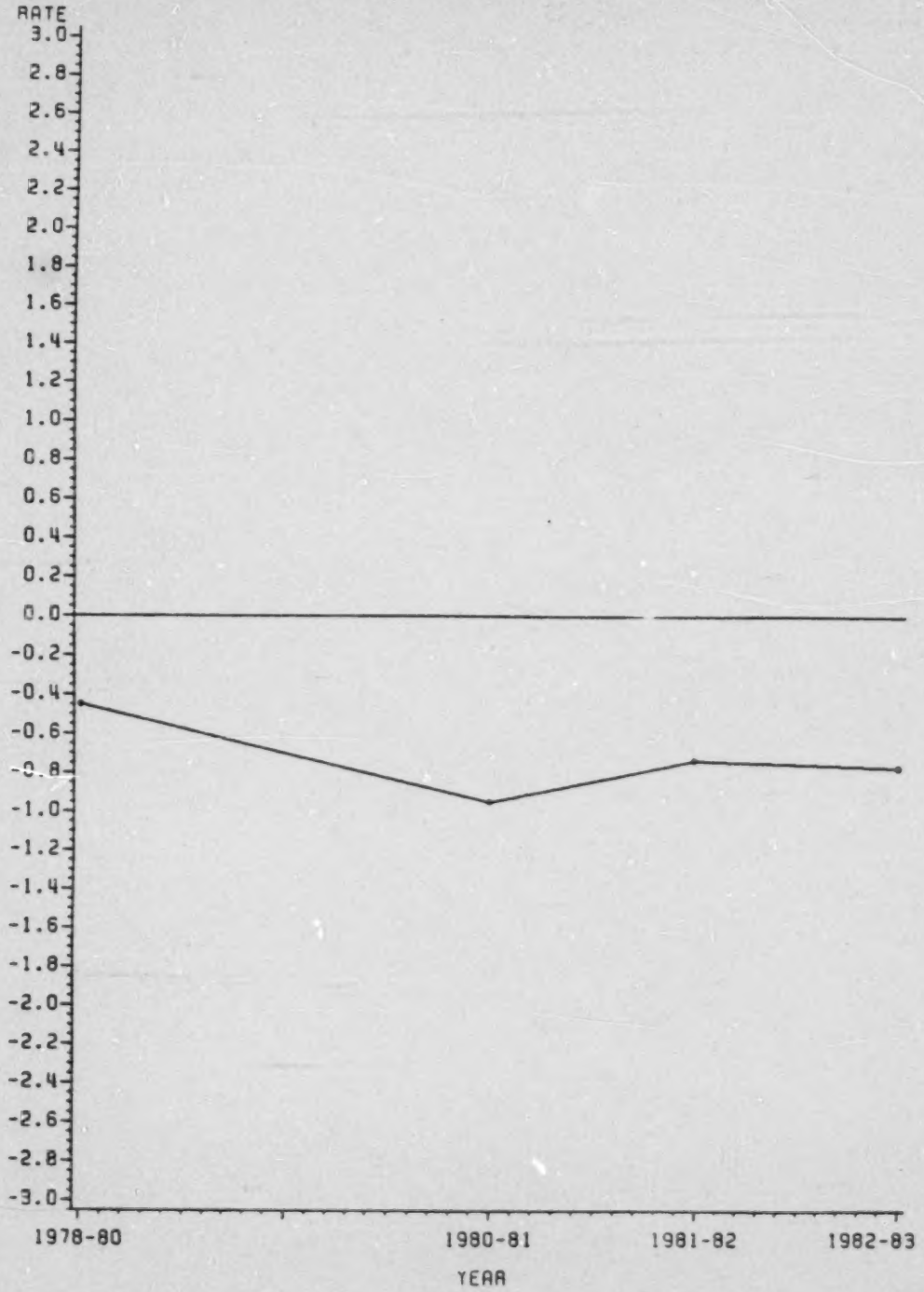


FIGURE 15

slightly during the 1981 to 1982 period. The graphs for Philadelphia County and Allegheny County, the two largest net out-migration counties in the state, show a decline in net out-migration during the early 1980s, particularly for Philadelphia County. On the other hand, the graph for Bucks County, a net in-migration suburban county, shows a slight decline in the rate of net in-migration which corresponds to the national trend of declining suburbanization in the early 1980s. The graph for Pike County, a high net in-migration resort area in the Poconos, shows a rapid decline in net in-migration between 1978 and 1982, but a slight increase in net migration between 1982 and 1983. Finally, Elk County, perhaps typical of rural counties in the state, shows an increasingly rate of net out-migration between 1978 and 1980 that has leveled off between 1980 and 1983. These graphs are illustrative of the unique data on the changing levels of out-migration for Pennsylvania counties provided by the IRS data.

How the IRS Data are Used

The U.S. Bureau of the Census combines these unique migration data with county level data on the number of births, the number of deaths, the number of elderly from medicare records, and the number of school age children from enrollment records to develop the official population estimates for states and all counties in the United States. We utilized the 1984 state and county estimates, the latest available at the present time, and extrapolated these estimates to July 1, 1985. Through this methodology we obtain an updated

based population for mid-year 1985, a date that corresponds to the first five year cycle of the population projections model. A 1980-85 net migration rate for the state and for each county can now be developed by utilizing the demographic accounting equation which adds to the 1980 Census population the expected number of births and subtracts the expected number of deaths for the 1980-85 period and compare this total with the 1985 population estimates. The difference is a measure of the number of net migrants. The five year migration rates for the early 1980s presented in Table 3, can be compared with those for the 1975-80 period (Table 2) in developing a typology of trended changes in net migration for Pennsylvania counties.

PENNSYLVANIA MIGRATION: 1985-2000

Our approach to the development of future migration patterns for Pennsylvania counties is a net migration typology justified to the pattern of projected state net migration change. Such a typology is based on the concept of trended changes in past county level net migration and on changes in the determinants of net migration.

Projected Level of State Net Migration

As shown in Table 4, Pennsylvania has been and continues to be a net out-migration state. However, the level of net out-migration has declined continually over the last 35 years, from an annual average of -47,500 in the 1950s, -37,900 in the 1960s, -35,160

Table 3. Estimated Net Migration for Pennsylvania: 1980-85

State and Counties	1980-85	
	Net Migration	Rate per 100
PENNSYLVANIA	-146982	-0.01
Adams	152	0.21
Allegheny	-50993	-3.49
Armstrong	1338	1.69
Beaver	-9326	-4.48
Bedford	83	0.17
Berks	3129	0.98
Blair	-4453	-3.20
Bradford	-775	-1.19
Bucks	15238	3.06
Butler	659	0.43
Cambria	-9587	-5.16
Cameron	-180	-2.67
Carbon	125	0.23
Centre	-722	-0.62
Chester	10627	3.25
Clarion	-238	-0.53
Clearfield	-190	-0.22
Clinton	-373	-0.93
Columbia	-701	-1.11
Crawford	-1104	-1.21
Cumberland	4080	2.24
Dauphin	-782	-0.32
Delaware	-12042	-2.13
Elk	-1223	-3.10
Erie	-6995	-2.41
Fayette	-2357	-1.45
Forest	22	0.43

Table 3. (Continued)

State and Counties	1980-85 Net Migration	1980-85 Rate per 100
Franklin	94	0.08
Fulton	277	2.09
Greene	233	0.56
Huntingdon	-175	-0.40
Indiana	-1594	-1.67
Jefferson	-266	-0.53
Juniata	99	0.50
Lackawanna	-4223	-1.85
Lancaster	9735	2.59
Lawarence	-2734	-2.51
Lebanon	643	0.58
Lehigh	1638	0.59
Luzerne	-7904	-2.30
Lycoming	-5863	-4.83
McKean	-2226	-4.33
Mercer	-3432	-2.64
Mifflin	-1335	-2.79
Monroe	8864	12.58
Montgomery	9123	1.40
Montour	27	0.15
Northampton	3438	1.50
Northumberland	-586	-0.58
Perry	1107	2.98
Philadelphia	-79890	-4.65
Pike	3204	17.71
Potter	479	2.62
Schuylkill	-3624	-2.26
Snyder	1520	4.39
Somerset	-281	-0.33
Sullivan	-241	-3.79

Table 3. (Continued)

State and Counties	1980-85 Net Migration	1980-85 Rate per 100
Susquehanna	703	1.81
Tioga	-1204	-2.86
Union	-191	-0.56
Venango	-1703	-2.58
Warren	-1009	-2.08
Washington	-1884	-0.85
Wayne	2250	6.27
Westmoreland	-10316	-2.60
Wyoming	302	1.10
York	6551	2.04

in the late 1970s, and -29,900 in the early 1980s. The population projections prepared for this project assume that this remarkably regular pattern of decline in net out-migration from Pennsylvania will continue during the 1985-2000 projection period. As Table 4 indicates, we project that the average annual number of net out-migrants will be about -24,000 during the late 1980s, approximately -21,000 in the early 1990s, and about -19,000 for the period between 1995 and 2000.

This pattern of projected net migration for the state is not only based on past migration patterns. A reduced level of net out-migration is consistent with the following trends in the determinants of migration found in the demographic literature: 1) the rapid reduction between 1985 and 2000 in the number of young Pennsylvania adults in the high out-migration 20-29 age cohorts, 2) a declining rate of suburbanization, 3) a hypothesized increase in the economic opportunities in Pennsylvania, particularly in the larger metropolitan centers, and the reduction in differences between the economic activity level of Pennsylvania and other states, 4) the increased significance of amenities, such as lakes and mountains found in some Pennsylvania counties, in residential choice decisions, and 5) the trend toward an increasingly older population which has lower rates of out-migration and potentially significant return migration of elderly former residents of the state from the south.

Table 4

Number of Net Migrants for Pennsylvania,
1950-1985, with Projections to 2000

Time Period	Reported Number of Net Migrants During Interval	Average Annual Number of Net Migrants
1950-1960[1]	-475,000	-47,500
1960-1970[2]	-378,000	-37,881
1975-1980[3]	-177,803	-35,160
1980-1985[4]	-147,000	-29,400
1985-1990	-	-24,000 (projected)
1990-1995	-	-21,000 (projected)
1995-2000	-	-19,000 (projected)

Sources:

1. Gladys K. Bowles and James D. Tarver, Net Migration of the Population, 1950-60 by Age, Sex and Color. Vol. 1, Part 1. Washington, D.C.: U.S. Department of Commerce, 1965.

2. Gladys K. Bowles and Everett S. Lee, Net Migration of the Population, 1960-1970, by Age, Sex and Color. Part 1, Athens, GA: University of Georgia, and U.S. Department of Commerce, 1975.

3. U.S. Bureau of the Census, 1980 Census of Population, Gross Migration for Counties, 1975 to 1980. Supplementary Report. No. PC80-S1-17, March, 1984. U.S. Government Printing Office, Washington, D.C.

4. Extrapolation for 1985 based on preliminary Census Bureau 1984 population estimates for Pennsylvania Counties. Pennsylvania State Data Center.

Projected County Patterns of Net Migration

Based on a detailed analysis of 1) 1975-80 and 1980-85 net migration patterns derived from U.S. Bureau of the Census sources, 2) the previously mentioned trends in the determinants of net migration, and 3) trends in group quarter populations, a typology of projected net migration patterns for Pennsylvania counties was developed. County-level patterns of net migration for the 1975-80 and 1980-85 periods are presented in Figure 16. As this map shows, 23 Pennsylvania counties, located mostly in the central and southeastern sections of the state and the counties in the Pocono region had net in-migration during both the 1975-80 and the 1980-85 periods. On the other hand, 28 counties, located primarily in the northern and western part of the state along with the major central city counties in eastern and northeastern Pennsylvania, had net out-migration during both the 1975-80 and 1980-85 periods. For the remaining 16 counties the pattern of net migration changed between the late 1970s and early 1980s. In ten of these counties the pattern changed from net in-migration during the late 1970s to net out-migration in the early 1980s. As shown in Figure 16, most of these counties are located in the western and central parts of the state. The remaining six counties changed from a net out-migration in the late 1970s to net in-migration in the early 1980s. With the exception of Montgomery County, these are relatively small population counties, located predominantly along the northern or southern border of the state.

Figure 16

PATTERNS OF NET MIGRATION
1975-80 AND 1980-85

PATTERN 1 = NET OUT MIGRATION 1975-80 AND 1980-85
PATTERN 2 = NET IN MIGRATION 1975-80 AND NET OUT MIGRATION 1980-85
PATTERN 3 = NET OUT MIGRATION 1975-80 AND NET IN MIGRATION 1980-85
PATTERN 4 = NET IN MIGRATION 1975-80 AND NET IN MIGRATION 1980-85

PSDC Statistical Graphics

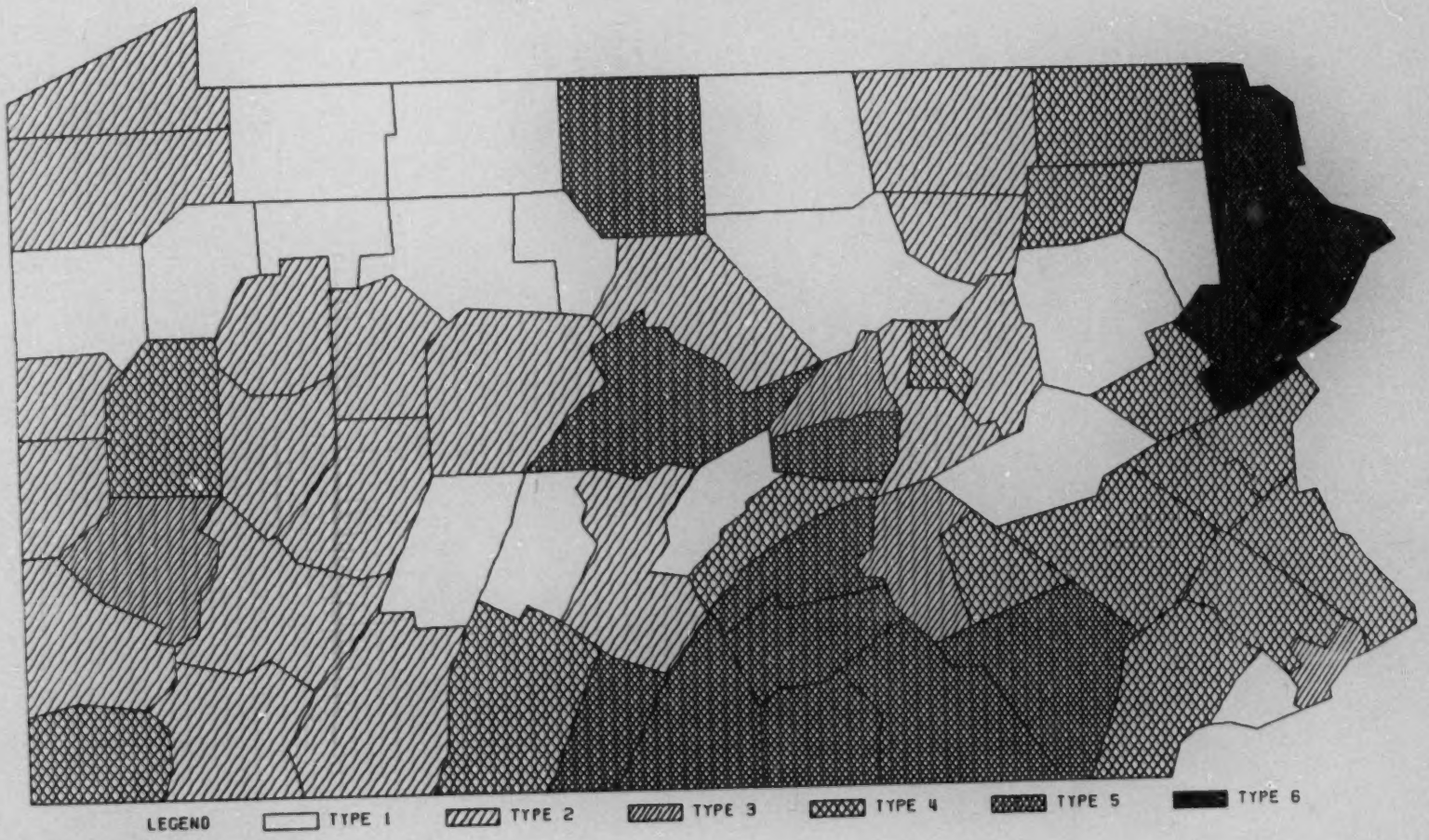
Based on the above analyses, counties were assigned to the following typology categories: 1) counties with continuing low net out-migration rates, 2) counties with slow reduction in net out-migration rates, 3) counties with rapid reduction in net out-migration rates, 4) counties with low and declining rates of net in-migration, 5) continuing low net in-migration rate counties, 6) continuing high net in-migration rate counties.

As shown in Figure 17, the major concentration of counties with projected continuing high in-migration rates are resort counties in the Pocono's. At the other extreme, counties with projected continuing low net out-migration rates are urban as well as rural counties located primarily in the western, central, and northeastern parts of the state. Counties projected to have rapid reduction in net out-migration rates are Philadelphia and Allegheny Counties, counties which contain the largest cities in the state.

The county typology of net migration presented above is based on trended changes using the 1975-80 and 1980-85 net migration data and on the previously discussed determinents of migration as they apply to specific county types (i.e., resort areas, suburban areas, large central cities, areas with high concentrations or young adults, etc.). Each county's projected age-sex-race specific migration rates for 1985-90, 1990-95, and 1995-2000 are presented in Table 5. The projected rates depend on past trends and on their classification in the typology. For continuing high net in-migration counties (type 6),

Figure 17

COUNTY NET MIGRATION TYPOLOGY
FOR PPPES POPULATION PROJECTIONS
1985 TO 2000



TYPE 1 = CONTINUING LOW REDUCTION IN NET OUT-MIGRATION RATES
TYPE 2 = SLOW REDUCTION IN NET OUT-MIGRATION RATES
TYPE 3 = RAPID REDUCTION IN NET OUT-MIGRATION RATES
TYPE 4 = LOW DECLINING RATES OF NET IN-MIGRATION
TYPE 5 = LOW NET IN MIGRATION RATES CONTINUING
TYPE 6 = HIGH NET IN MIGRATION RATES CONTINUING

PSDC Statistical Graphics

Table 5. Projected Net Migration Rates for Pennsylvania Counties: 1985-2000

State and Counties	Projected Rate per 100 Persons		
	1985-90	1990-95	1995-2000
PENNSYLVANIA	-0.99	-0.86	-0.77
Adams	0.09	0.13	0.15
Allegheny	-3.12	-2.73	-2.40
Armstrong	1.74	1.56	1.32
Beaver	-4.25	-3.98	-3.91
Bedford	0.21	0.15	0.07
Berks	1.05	0.96	0.79
Blair	-3.21	-3.26	-3.16
Bradford	-1.01	-1.00	-1.04
Bucks	2.70	2.45	1.95
Butler	0.55	0.56	0.51
Cambria	-5.08	-5.16	-5.00
Cameron	-2.47	-2.43	-1.89
Carbon	0.16	0.04	0.01
Centre	0.05	0.74	0.54
Chester	2.73	2.34	1.78
Clarion	-0.95	0.10	0.56
Clearfield	-0.15	-0.23	-0.34
Clinton	-1.42	-1.38	-1.18
Columbia	-1.20	-0.26	0.10
Crawford	-1.23	-1.17	-1.01
Cumberland	2.35	2.38	2.22
Dauphin	-0.12	-0.13	-0.19
Delaware	-2.01	-1.82	-1.48
Elk	-2.80	-2.69	-2.91
Erie	-2.45	-2.36	-2.29
Fayette	-1.55	-1.46	-1.41
Forest	0.24	0.47	0.61

Table 5. (Continued)

State and Counties	Projected Rate per 100 Persons		
	1985-90	1990-95	1995-2000
Franklin	0.13	0.23	0.42
Fulton	1.88	1.50	1.33
Greene	0.43	0.35	0.10
Huntingdon	-0.40	-0.45	-0.67
Indiana	-1.60	-1.00	-0.91
Jefferson	-0.42	-0.47	-0.62
Juniata	0.53	0.44	0.31
Lackawanna	-1.83	-1.75	-1.54
Lancaster	2.59	2.51	2.43
Lawrence	-2.33	-2.24	-2.32
Lebanon	0.65	0.51	0.39
Lehigh	0.71	0.65	0.50
Luzerne	-2.31	-2.25	-2.06
Lycoming	-4.71	-4.73	-4.50
McKean	-4.28	-4.42	-4.28
Mercer	-2.43	-2.29	-2.21
Mifflin	-2.81	-2.70	-2.45
Monroe	12.27	11.99	11.01
Montgomery	1.32	1.13	0.82
Montour	0.63	0.01	-0.96
Northampton	1.41	1.20	0.93
Northumberland	-0.55	-0.54	-0.55
Perry	2.95	2.63	2.28
Philadelphia	-4.06	-3.93	-3.60
Pike	17.84	16.89	14.83
Potter	2.63	2.49	2.39
Schuylkill	-2.23	-2.17	-1.95
Snyder	3.95	3.29	3.02
Somerset	-0.28	-0.39	-0.50
Sullivan	-4.74	-4.03	-3.81

Table 5. (Continued)

State and Counties	Projected Rate per 100 Persons		
	1985-90	1990-95	1995-2000
Susquehanna	1.85	1.61	1.38
Tioga	-2.99	-2.78	-2.48
Union	-0.21	-0.55	-1.11
Venango	-2.64	-2.84	-2.80
Warren	-2.04	-2.12	-2.14
Washington	-0.77	-0.70	-0.68
Wayne	6.21	5.95	5.21
Westmoreland	-2.52	-2.42	-2.51
Wyoming	0.84	0.34	0.20
York	2.13	1.89	1.54

migration may change relatively little due to changes in the changing age composition to which these rates are applied.

In addition, the trending of county rates by age, race, and sex is subject to an important constraint. That is, the sum of net migration for an age, sex, and race group (say, white females, age 10-14) across all counties is set to equal the state net migration total for that age-sex-race group. This procedure insures that the sum of net migration across all counties will equal the projected net migration for the state reported in Table 5. Thus patterns of net migration change expected within the state will necessarily be affected by patterns of declining net out-migration expected for the state as a whole during the 1980-2000 period.

CONCLUSION

In conclusion, future net migration patterns for the state and for individual counties have been developed, based on the concept of trended changes in historical and the most recent net migration data available from U.S. Bureau of the Census and Internal Revenue Service sources and on the demographic literature concerning trends in the determinants of migration. The resulting migration data for each of the projection cycles of 1985-90, 1990-95, and 1995-2000 will be combined with the fertility and mortality information presented in our earlier reports to produce the total projected resident population of each county in the state.[3/]

3/ See: Fertility in Pennsylvania: 1960-2000 and Mortality Experience in Pennsylvania: 1960-2000.

References

Bowles, Gladys K., and Everett S. Lee
1975 Net Migration of the Population, 1960-1970, by Age, Sex and Color. Athens GA: University of Georgia and U.S. Department of Commerce.

Bowles, Gladys K., and James D. Traver
1965 Net Migration of the Population, 1950-1960, by Age, Sex and Color. Washington, D.C.: U.S. Department of Commerce.

Frey, William H.
1985 "Mover Destination Selectivity and the Changing Suburbanization of Metropolitan Whites and Blacks." Demography 22:223-43.

Forstall, Richard L., and Richard A. Engels
1984 Growth in Nonmetropolitan Areas Slows. Washington, D.C.: U.S. Bureau of the Census.

Heaton, Tim B., William B. Clifford, and Glenn V. Fuguitt
1981 "Temporal Shifts in the Determinants of Young and Elderly Migration in Nonmetropolitan Areas." Social Forces 60:41-60.

Lichter, Daniel T., Gordon F. De Jong, and John M. Kennedy
1985 Mortality Experience in Pennsylvania: 1960-2000. Population Issues Research Center Working Paper No. 1985-21. University Park, PA: The Pennsylvania State University.

Long, Larry H., and Diana DeAre
1981 "The Suburbanization of Blacks." American Demographics 3(Sept.)16-20.

Tuckerm C. Jack
1976 "Changing Patterns of Migration Between Metropolitan and Nonmetropolitan Areas in the United States: Recent Evidence." Demography 13:435-44.

U.S. Bureau of the Census, Current Population Reports
1981 Geographical Mobility: March 1975 to March 1980. Series P-20, No. 368. Washington, D.C.: U.S. Government Printing Office.

U.S. Bureau of the Census
1982 Characteristics of the Population. PC80-1-A40. Number of Inhabitants. Washington, D.C.: U.S. Department of Commerce.

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